North Coast Watershed Assessment Program

DRAFT

Mattole Watershed Synthesis Report

The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.

Public Review Draft

Analyses and Results by Subbasin

Mattole Basins: Estuary, Northern, Eastern, Southern, Western

Introduction

For the purpose of the NCWAP study of the Mattole River Basin, the basin has been divided into five subbasins based on 25 distinct planning watersheds as defined by Calwater 2.2a. Four of the five subbasins in the basin were designated based on geography, geology, climate patterns, and land use, and conforms with Calwater 2.2 Planning Watershed boundaries. The fifth subbasin, the Estuary, has been designated as a distinct subbasin for this study because of the importance of the estuarine environment as a down-migrant holding area for juvenile fish stocks.

- The Estuary subbasin is two square miles in area and contains the basin downstream of the confluence of Bear Creek and the Mattole River mainstem. The estuary drains the Mattole River to the Pacific Ocean. The Mendocino Triple Junction, where the Gorda, the North American, and the Pacific geologic plates meet, occurs just southwest of the river mouth, making the Mattole River basin as a whole one of the most geologically unstable in California. The southern extent of the basin is owned and managed by the BLM as part of the King Range National Conservation Area.

- The Northern subbasin is located between the Estuary and Honeydew Creek and one of three towns in the watershed, Petrolia, is located near the confluence with the lower North Fork Mattole River and the Mattole River mainstem. It drains an area of 98 square miles and is the least geologically stable of the subbasins. The largest contiguous old growth remaining in the entire watershed can be found here, but vegetation type is predominantly second-growth mixed hardwood/Douglas Fir forest, although grasslands are a significant component. It is partially bordered on the east side by Humboldt Redwoods State Park. Steelhead are currently present in the subbasin. Based on previous DFG surveys, coho were once found here.

- The Eastern subbasin is located between Honeydew Creek and Bridge Creek and the second of the three towns, Honeydew, is located near the confluence of Honeydew Creek and the Mattole River mainstem. It drains an area of 79 square miles and geology and slope stability varies widely. Much of the land in this subbasin has been converted from large ranchlands to rural sub-divisions. The predominant vegetation type is second growth mixed hardwood/Douglas fir forests. Coho, chinook, and steelhead trout can all be found in this subbasin.

Insert Subbasin Map.

- The Southern subbasin is located south of Bridge and McKee Creeks and encompasses the headwaters of the Mattole River at the southern end. It is divided between Humboldt and Mendocino Counties. The third of the three towns, Whitethorn is located near the confluence of upper Mill Creek and the Mattole River mainstem. It drains an area of 28 square miles and is the most geologically stable of the subbasins. The predominant vegetation type is mixed hardwood/coniferous forest including old and second growth Redwood forests. This subbasin is the most densely populated of the subbasins but is considered to have some of the best remaining fish rearing habitat of the entire basin. Coho, chinook, and steelhead trout can all be found in this subbasin.

- The Western subbasin is located from the border with the Estuary in the north to the headwaters of Bear Creek in the south. It drains 89 square miles and geology and slope stability varies. Much of this subbasin is under public ownership, managed by the BLM as part of KRNCA. The predominant vegetation type is second growth mixed hardwood/Douglas fir forest. King Peak, at 4,087’ is the highest elevation in the basin.

Mattole Estuary

Introduction

Estuaries are critical habitats for all anadromous salmonids. Estuaries are the nexus between freshwater and marine environments through which salmonids pass as juveniles during seaward migrations and as adults to gain access to their natal rivers during spawning migrations. Estuaries are also recognized as valuable salmonid nursery areas because they provide abundant food supplies, diverse habitat and offer protection from predators. Fish that utilize estuaries for an important part of their life cycle, such as salmonids, are referred to as estuarine-dependent.

During seaward migrations, all juvenile chinook salmon, coho and steelhead utilize at least a brief estuarine residence while they undergo physiological adaptations to salt water and imprint on their natal stream. Juvenile salmonids may also extend their estuarine residency to utilize the sheltered and food rich environment for several months or a year before entering the ocean. Studies have revealed that juvenile salmonids utilizing estuaries for three months or more return to their natal stream at a higher rate than non-estuarine reared siblings (Riemers 1976, Nicholas and Hankin). Estuarine reared salmonids may be at an advantage because they enter the ocean at a larger size or during more favorable conditions. Entering the ocean at a larger size may be advantageous by allowing juvenile salmonids to avoid predation or increasing the amount of prey items that can be used for food. Additionally, entering the ocean in mid-summer to early fall may increase survival if ocean conditions are unfavorable in the spring and early summer.

Estuarine rearing is a strategy that adds diversity to juvenile salmonid life history patterns and increases the odds for survival of a species encountering a wide range of environmental conditions in both the freshwater and marine environments. Additionally, an extended estuarine residency may be especially beneficial for salmonids from rivers where low summer flows or warm water temperatures severely limit summer rearing habitat.

High levels of filling with sediment transported from the upper watershed through periodic flooding has reduced the Mattole River estuary volume and altered the physical and biologic function of estuarine ecosystem and adjacent wetlands. These impacts include elevated summer water temperatures. This present highly-impacted state of the estuarine habitat is likely limiting the production of salmonids in the Mattole River. In fact, extensive studies, led by Humboldt State University from 1985-92, found that chinook juveniles were suffering lethal impacts during summer rearing in the estuary. In response, the Mattole Salmon Group initiated a rescue trapping and rearing program which has had limited success Long term watershed scale strategies are needed to improve the estuarine habitat, and efforts will require private landowner and local stakeholders cooperation. The Mattole dune system is unique in that the aggressive and introduced European beachgrass, *Ammophila arenaria*, has not yet encroached on the Mattole dunes as it has on most coastal dunes north of San Francisco. The estuary is probably the most well-studied of all the Mattole subbasins in the basin.

The Mattole estuary is characterized by a low gradients and wide channel, occupying a relatively wide valley (see map on next page). The system of gravel bars along the Lower Mattole has remained relatively constant between the years 1984 to 2000. Minor changes have been observed chiefly with respect to the location and development of vegetated bars.

Insert Estuary Map.

Climate

In the Estuary subbasin, average air temperatures are approximately 55° F and range from 40° to 65° F. Rainfall in this area averages 60 inches per year. Summer fog is usually present here although fog is not a common climatic feature of the Mattole basin.

Hydrology

The Estuary subbasin contains small sections of the Petrolia and Shennanigan Ridge Calwater 2.2a Planning Watersheds (Calwater Units) (see map on next page). There are no perennial tributaries in this subbasin (see map on previous page).

Geology

Vegetation

The vegetation of the Estuary subbasin is very diverse. The Mattole Restoration Council's Elements of Recovery, (1995), identifies nine distinct plant communities. Willows and red alder are found along past and present river channels. Lower floodplains contain grasses with scattered willows and coyote brush. Grasslands predominate on higher floodplains and hillslopes which have been cleared, cut, or grazed. Hillslope gullies, washes, and ravines contain coniferous/deciduous forest, mostly second and third growth coniferous forests with large stands of mature tanoak. Dune areas contain beach layia, a federally listed endangered plant species.

Land Use

Human habitation of the estuary area goes back hundreds of years as evidenced by shell middens on the beach south of the estuary. The native inhabitants hunted, fished, and made use of the diverse flora and fauna of the area. Euro-Americans arrived in the 1850s, bringing pasture and row crops to the river bottom flats, and sheep and cattle grazing to the surrounding hillsides. The largest land-use change occurred in 1970, with the creation of King Range National Conservation Area, managed by the Bureau of Land Management. Although limited grazing still occurs, BLM currently manages the estuary area for conservation and recreation. The area contains a public campground and trailhead at the mouth of the river for the 25-mile "Lost Coast Trail" from the Mattole River to Shelter Cove.

Fluvial Geomorphology

The Mattole Estuary is characterized by a lowest gradients and widest channel, occupying a relatively wide valley. The system of gravel bars along the Lower Mattole has remained relatively constant between the years 1984 to 2000. Minor changes have been observed chiefly with respect to the location and development of vegetated bars. Between 1942 and 1965 the Mattole Estuary was dramatically widened and large areas of vegetation were lost (see Figures 10 and 11).

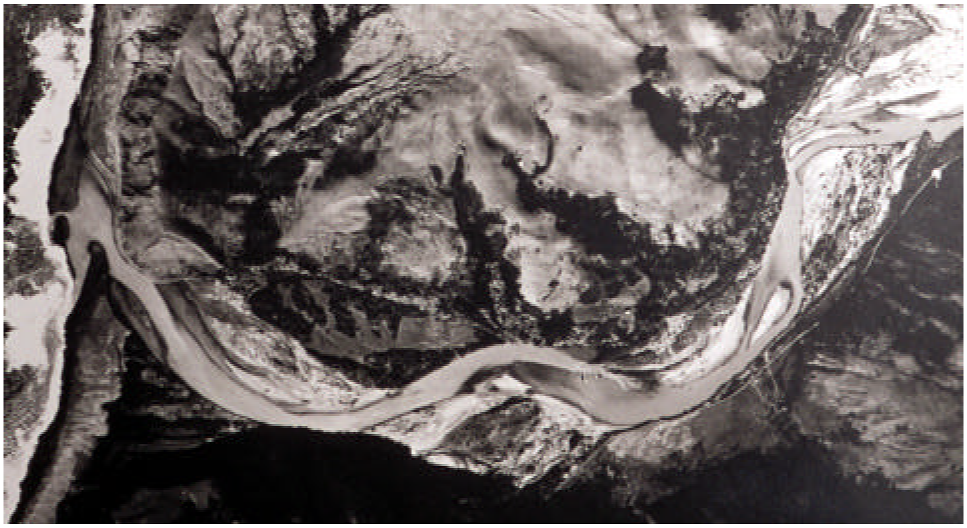

Figure 10: The Mattole River Estuary in 1942.

Riparian vegetation appears as dark patches and strips on the light gravel bar. The mouth was open when this photo was taken. Although the flow was not low, the wetted channel is narrow in some places. Photo provided by the Mattole Restoration Council.

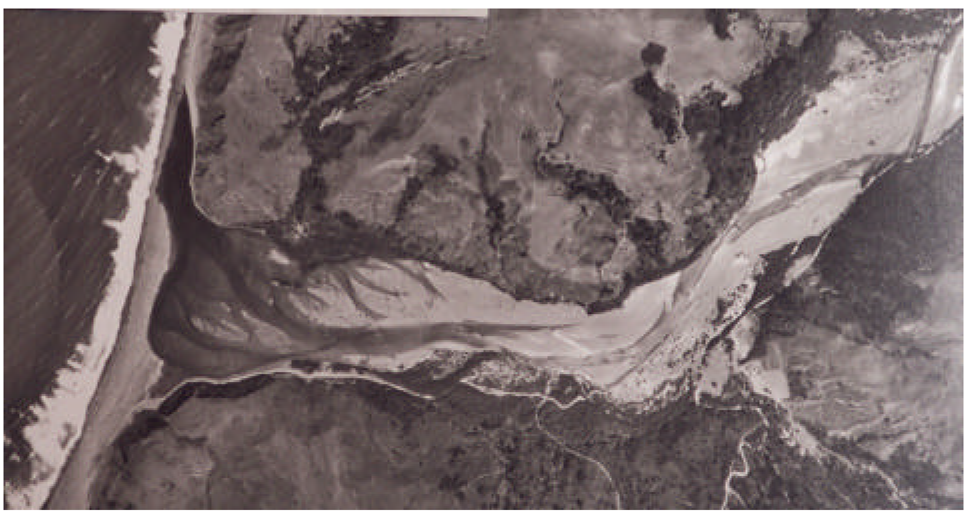

Figure 11: The Mattole River Estuary in 1965.

Riparian vegetation is rare along the wetted channel. At the time of this photo, the mouth was closed and some relative depths of the lagoon are evident. The wetted channel is wide and braided. Photo provided by the Mattole Restoration Council.

Aquatic/Riparian Conditions

Field observations conducted by Humboldt State University students from 1985-1992 and ongoing field observations indicate lack of pools, lack of in-stream structures for cover and lack of riparian canopy around the Estuary. These factors contribute to elevated water temperatures. Additionally, lack of depth and escape cover for juveniles and adults contributes to possible natural-predator predation problems. There is not enough data to determine whether water chemistry is a limiting factor in the Estuary.

Fish History and Status

According to archived accounts, historic levels of salmonid populations were very abundant. There are many long-time resident accounts of excellent salmon fishing opportunities. A much-anticipated annual event was the estuary/lagoon opening, usually in October. Local residents would camp around the estuary and catch great numbers of salmon as the first of the runs migrated upstream. Populations decreased to the point that studies by Humboldt State University students document no chinook over-summering in the estuary in 1988. Chinook had been found the previous three years. Dive observations since then indicate the presence of juvenile steelhead but not chinook.

Fish Habitat Relationship

Sediment and temperature impacts are currently deleterious to summer rearing salmonid populations. Present conditions are a product of upstream natural processes and human land uses. Although summer water temperatures are currently documented to be higher than fully suitable EMDS values, there is not enough information over time to understand temperature trends. Because juvenile Chinook over-summer in the estuary, they are affected by temperature to a greater degree than steelhead or coho. The life cycle of young chinook historically included a summer rearing phase in lagoon or estuarine habitats. Juveniles typically entered the esturary in spring and left for the sea in autumn. In response to the estuarine conditions for rearing chinook juveniles, the Mattole Salmon Group has conducted rescue rearing operations since 1994. The project traps down migrating chinook juveniles at river mile 3.0 adjacent to summer rearing tanks at Mill Creek, and releases them in the fall for out-migration. This project needs to continue as an assessment program to evaluate its efficacy by marking all released fish.

Subbasin Trends

The trends for several factors within the Estuary can be summarized as follows. The size and extent of the riparian vegetation will continue to be dependent on natural conditions since it is largely within Bureau of Land Management (BLM) ownership and not subject to management activities. The main road in the estuary area is along the valley floor. It has a rocked road surface, an inside ditch and culverted crossings of tributary streams, and is used year-round. This road may deposit some fines into the estuary system during wet weather, but is on level ground with minimal road gradient. The number of roads is not expected to increase because of BLM's current land-use objectives.

Stream temperature data in 1999 indicated that peak maximum temperatures exceeded 73º at the river mouth and 78º one mile upstream. Data presented by the Department of Water Resources in their report evaluated temperatures from 1996 to 1999 and 2001, not long enough to establish a trend in water temperatures.

There is no data on suspended sediment levels within the estuary. Gravel bars remained stable from 1984-2000. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one-hundred year return flood events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Subbasin Issues

- The current stream reach EMDS model is not configured to assess estuarine conditions with its parameters. However, field observations during extensive academic studies and ongoing field observations by the DFG and the Mattole Salmon Group, indicate pool habitat, escape and ambush cover, substrate embeddedness and water temperature are likely unsuitable for salmonids.

- Comparing twenty years of United States Geologic Survey and Mattole Salmon Group flow data, there is no detected correlation between a particular discharge rate and the closure of the mouth. However, at flows below 120 cfs closure is imminent, and during all years sampled, 44 cfs was the lowest flow at which the mouth closed.

- Predation upon depressed fish populations by birds and mammals is thought to be a problem in the estuary and is exacerbated by a lack of depth and escape cover for juveniles and adults. With salmonid populations at low levels, even natural rates of human and other predation can become an inordinate problem for fisheries.

- Water chemistry data is not sufficient at this time to quantify whether chemistry is an estuarine factor affecting fishery production. There is some limited evidence that after the mouth closes, dissolved oxygen may decrease to zero in the lower strata of the water column. Benthic organisms would likely be most affected by this condition.

- Future riparian habitat and function in the estuary will most likely not be impacted adversely by land use; it is in public land ownership and is managed by BLM for retention of natural conditions. The estuary has a very diverse assemblage of flora and fauna.

- The estuary area has the highest recreational use and value, to the public at large, than any other subbasin in the Mattole.

Subbasin Issue Synthesis

<u>**Working Hypothesis 1:**</u> ***The present state of estuarine habitat is limiting the production of salmonids, especially chinook, in the Mattole River.***

<u>**Supportive Findings:**</u>

- Estuaries provide critical habitat for all anadromous salmonid species.

- Sediment from upstream has been delivered by storm events and has accumulated in the low gradient estuarine channel.

- Sources of upstream sediment include natural background erosion and additional erosion from land use.

- Water temperatures in the estuary, as a result of warming effects upstream, periodically exceed a level that is fully supportive of salmonids (Dynamics of Recovery 1995).

<u>**Recommendations:**</u>

6. Continue the chinook juvenile rescue rearing program with a tagging and effectiveness monitoring program.

7. Institute a basin-wide road/erosion assessment, treatment and erosion control program to reduce sediment yield where possible. Follow land use guidelines in Department of Mines and Geology Note 50 (Department of Conservation, 1997; see Appendix X).

8. Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.

9. Monitor summer water and air temperatures on a continuous 24-hour basis to detect long-range trends and short-term affects on the aquatic / riparian community.

10. Examine the role of the mainstem Mattole River in elevated water temperatures.

Northern Mattole Subbasin

Introduction

The “Northern” subbasin is located between the estuary and Honeydew Creek (River Mile 26.5) along the northeastern side of the Mattole mainstem (see map on following page). There are eighteen perennial streams that drain a watershed area of 98 square miles. The DFG has recently surveyed 10.6 miles of the subbasin’s anadromous reaches. Elevations range from 5’ at the estuary to approximately 2,500’ in the headwaters of the tributaries.

The watershed is largely managed for timber production and cattle ranching. The town of Petrolia is located in this subbasin at the confluence of the Lower North Fork and the Mattole River. Some back-to-land homesteads are near Petrolia. Controversy concerning timber harvest issues between the Pacific Lumber Company and the “Defenders of the Mattole” are focused on Rainbow and Long ridges in this subbasin. Although Pacific Lumber is operating under and approved Habitat Conservation Plan, some of their timber harvesting plans are first entries into old-growth stands, causing protests that include civil disobedience.

Insert Northern Subbasin Map.

Table 13 Surveyed Streams with Estimated Anadromy in the Northern Subbasin

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
Jim Goff Gulch	N		0.7		
Jeffry Gulch	N				
Lower North Fork Mattole River	N		8.0		
East Branch Lower North Fork Mattole River	N		0.9		
Sulphur Creek	Y	0.5		1	B4
Unnamed Tributary #1 to Sulphur Creek	Y	0.1		1	C4
Unnamed Tributary #2 to Sulphur Creek	Y	0.5		1	B4
Conklin Creek	Y	0.6	2.2	1	C4
McGinnis Creek	N		3.1		
Thorton Creek	N				
Pritchett Creek	N				
Singley Creek	N				
Holman Creek	N				
Upper North Fork Mattole River	N		3.5		
Oil Creek	Y		3.3		
	Y	0.3		1	A4
	Y	2.0		2	B2
	Y	0.3		3	A4
	Y	0.7		4	A2
Green Ridge Creek	N		0.6		
Devil’s Creek	Y		0.8		
	Y	0.7		1	B2
	Y	0.7		2	A3
Rattlesnake Creek	Y	4.2	3.0	1	

Climate

The Northern subbasin experiences the widest range of both temperature and precipitation. Air temperatures range from below freezing in winter to over 100° F in summer. Temperatures near Petrolia are moderated year-round by the proximity of the ocean while the inland areas experience the extremes. Rainfall averages range from 60 inches near Petrolia to 115 inches on the eastern ridgetops. Although most precipitation falls as rain, snowfalls in the higher regions of the subbasin are not uncommon.

Hydrology

The Northern subbasin is made up of nine complete Calwater Units and most of the Petrolia Calwater Unit (map on previous page). There are 69.6 perennial stream miles in 18 perennial tributaries in this subbasin. Seven of these tributaries have been inventoried by the DFG. There were 11 reaches, totaling 10.6 miles in the inventory surveys. The inventories included channel and habitat typing, and biological sampling.

In their inventory surveys, the DFG crews utilize a channel classification system developed by David Rosgen (1994) and described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

In the Northern subbasin, there were four type A channels, totaling 2.0 miles; four type B channels, totaling 3.7 miles; and two type C channels, totaling 0.7 miles. Type A stream reaches are narrow, moderately deep, single thread channels. They are entrenched, high gradient reaches with step/pool sequences. Type A reaches flow through steep V- shaped valleys, do not have well-developed floodplains, and have few meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders. Type C stream reaches are wide, shallow, single thread channels. They are moderately entrenched, low gradient reaches with riffle/pool sequences. Type C reaches have well-developed floodplains, meanders, and point bars (Flosi, et al., 1998).

Geology

The geology of the Northern subbasin is overall the most structurally disrupted and least stable of the basin. The bedrock underlying the northern subbasin is dominated by mélange and broken units of the Franciscan Coastal terrane composed of scattered blocks of intact rock set within a matrix of pervasively sheared argillite and sandstone. The mélange is generally too weak to support development of steep slopes. Accordingly, a “soft” topography of rolling hillsides, moderate slopes and rounded crests has developed over much of this northerly portion of the watershed. Relatively deep weathering profiles and clayey residual soils tend to develop on the mélange that are subject to chronic down-slope movement through soil creep. Grassy vegetation generally develops in these areas of weathered mélange where conifer and hardwood trees have a difficult time becoming established on the mobile mantle of clayey soil. The Northern subbasin has the largest proportion of grassland in the basin. An abundance of active and dormant landslides of different types have been mapped in the subbasin, including large landslide complexes that impact entire hillsides covering many 10’s of acres. Historically active earthflows are particularly common here in comparison to their occurrence in the other subbasins. The delivery of sediment to streams through gully erosion and debris slides associated with larger active and dormant landslides is also prevalent in the subbasin as well as debris flows from harder terrain at higher elevations. In the Lower North Fork, the high rate of sediment input from erosion and mass wasting is reflected in the accumulation of debris and alluvial fans at the mouths of many tributary drainages. An irregular drainage pattern lacking a preferred orientation and spacing has developed on the disrupted bedrock geology underlying the upper reaches of most streams in the Northern subbasin. Terrace remnants of older alluvial deposits and strath surfaces extend over the broad valley bottoms above the active channel.

Vegetation

There is more grassland in this subbasin than in any of the others (Figure 12). The forested vegetation reflects past harvesting and most stands are in smaller size classes. Small stands of old-growth Douglas-fir forest are in private ownership. While there are a tremendous number of springs originating near the ridgetops, some of which have definite channels and narrow riparian strips connecting to the stream systems, many tributaries in the grassland lack riparian vegetation.

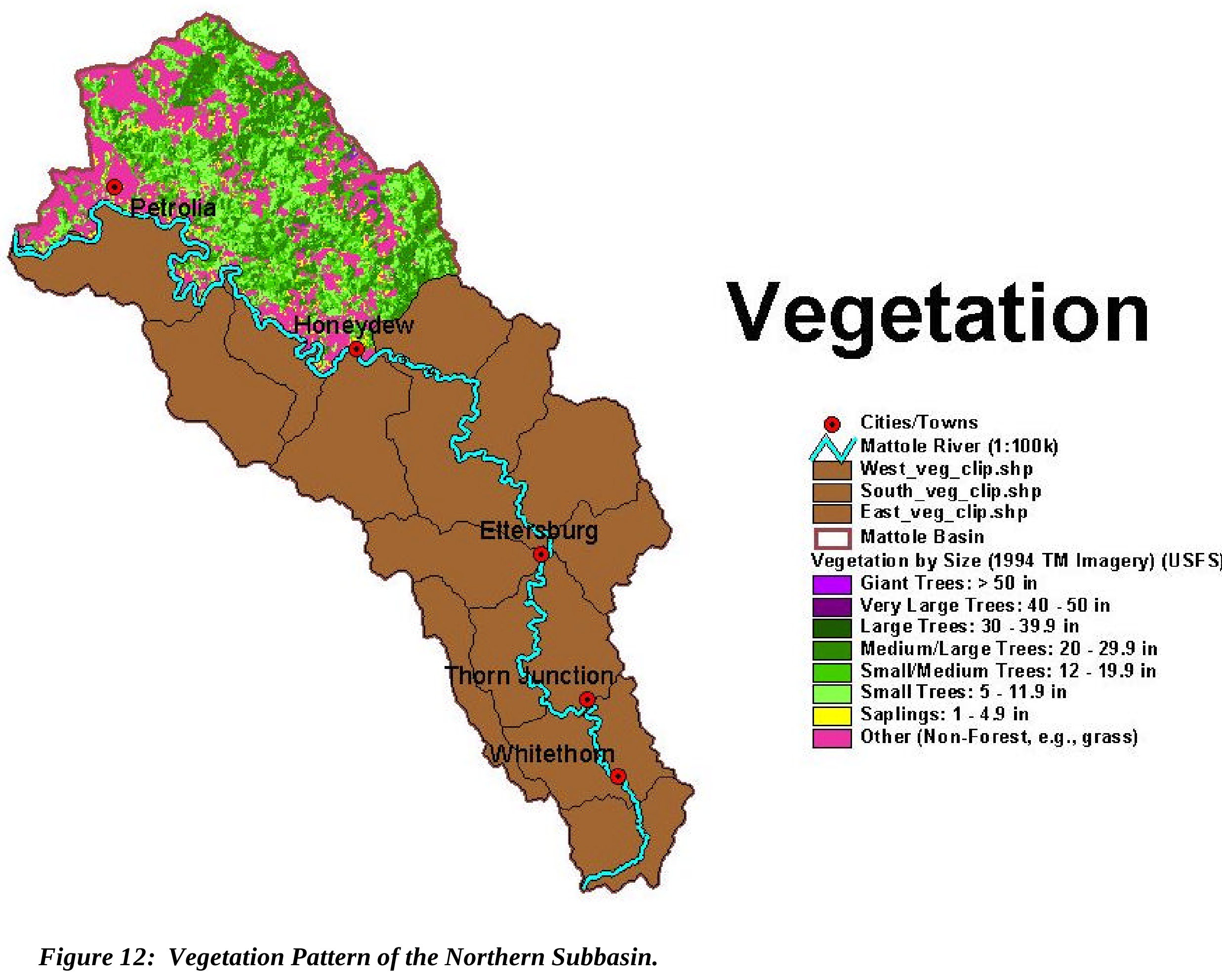

Figure 12: Vegetation Pattern of the Northern Subbasin.

Land Use

This subbasin contains the largest blocks of ownership in private hands, including Pacific Lumber as the only industrial timberland owner (Figure 13). Census 2000 data indicates that 200 people have their permanent residence in this subbasin. Grazing and timber management are the major land use activities (Figure 14, Table 14). The town of Petrolia is in this subbasin. The 1941 aerial photographs show widespread indications of grazing and written accounts make it clear that Petrolia and the surrounding grasslands have influenced the local landscape since settlement in the 1860s.

Please note that the land use and riparian maps in the subbasin sections of this report will be reformatted to resemble the following maps. In addition, map captions will be more detailed.

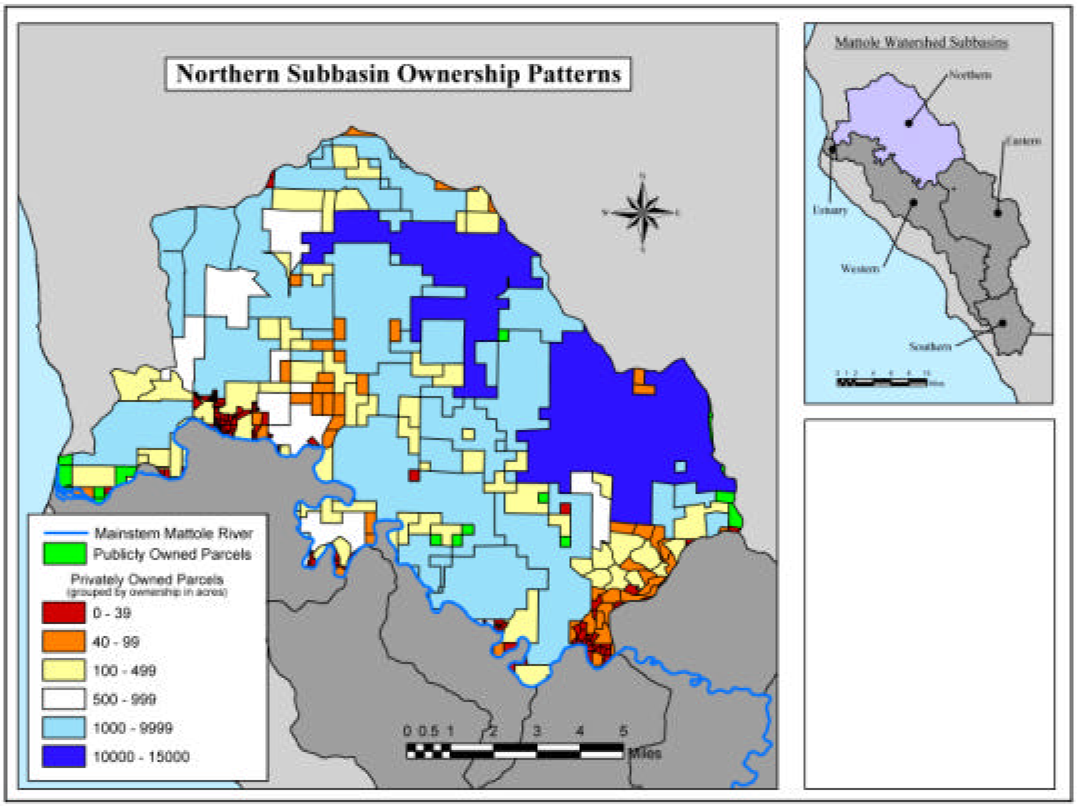

Figure 13: Ownership Pattern of the Northern Subbasin.

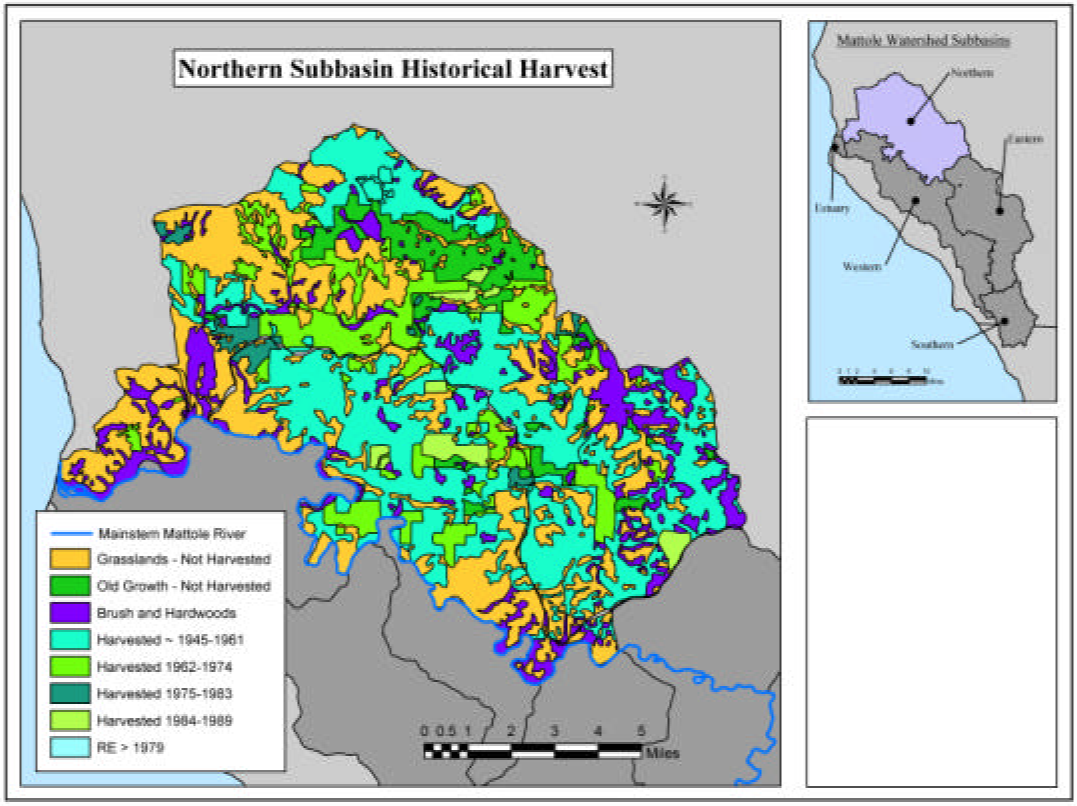

Figure 14: Timber Harvest History for the Northern Subbasin.

Table 14: Timber Harvest History, Northern Mattole Subbasin.

TIMBER HARVEST HISTORY - NORTHERN MATTOLE SUBBASIN		
	Total Acres	Percent of Area
Harvested 1945-1961	21,555	34%
Harvested 1962-1974	7,675	12
Harvested 1975-1983	968	2
Harvested 1984-1989	1,628	3
Harvested 1990-1999	3,440	5
Harvested 2000-2001 (partial)	339	<1

Fluvial Geomorphology

The fluvial geomorphology of the Northern subbasin is characterized by the highest percentage of disturbed channel and stream bank erosion. Specific areas include large sections of streams within the Camp Mattole, McGinnis Creek, Rainbow, Oil Creek, and Rattlesnake Creek planning watersheds. Table X (not yet created) illustrates the range in percent disturbed channel for the 1984 and 2000 aerial photographs. The Northern Mattole subbasin shows a nearly constant range with respect to time. However, Joel Flat is noteworthy because in certain areas of the planning watershed it has shown a 50 percent decrease in disturbed channel.

Several large areas of high sediment deposition were observed along the Lower North Fork near Petrolia and Upper North Fork near Honeydew. These areas of deposition have been attributed to backwater effects with the mainstem Mattole.

The very geologically unstable condition of the Northern subbasin is borne out by the highly aggraded conditions in the lower reaches of subbasin tributaries that have vastly simplified instream salmonid habitat. These naturally impacted conditions (perhaps exacerbated by land usage), especially in the depositional, lower reaches of the Upper and Lower North Forks of the Mattole, both major tributaries of the system, have adversely affected summer juvenile rearing habitat and created less than ideal spawning conditions for adults.

Aquatic/Riparian Conditions

Riparian vegetation when viewed as a 90 meter or approximately 300 foot wide unit on each side of streams tends to resemble the size of the vegetation of the general landscape since most of the harvesting occurred prior to the designation of stream protection zones (Figure 15). This is a different width than is used in the EMDS model for canopy density and large woody debris recruitment (200 feet, each side) and for the stream reach canopy shade over the stream component (field measurement and/or 150 feet each side).

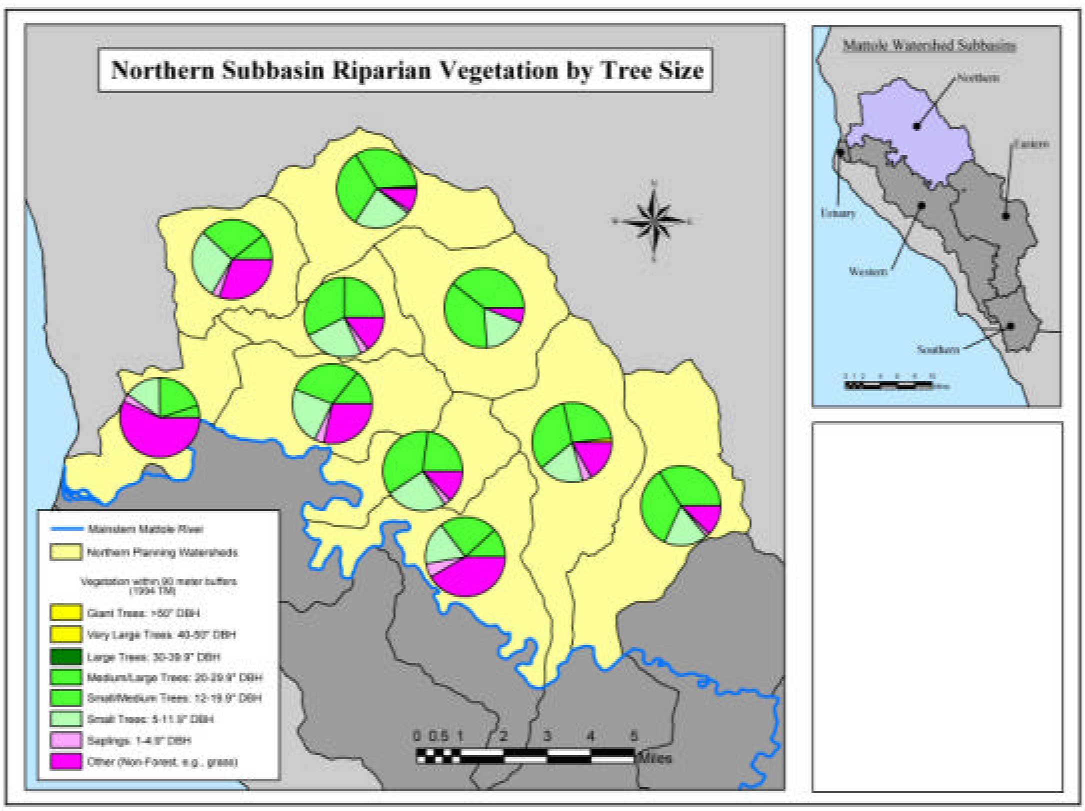

Figure 15: Riparian Vegetation of the Northern Subbasin.

The average diameter of this stream-side unit is increasing as the forested stands associated with them also increase. Visual observation along the County Roads adjacent to the Mattole River and the downstream reaches of the North Fork and the Lower North Fork indicates that the riparian area is often defined by the location of these roads. As examples of the differences between the vegetation of the planning watersheds and their near-stream 90 meter riparian width, the data for two planning watersheds are shown. The Camp Mattole planning watershed is adjacent to the Mattole River while Oil Creek contains old-growth forest and encompasses the headwaters of Oil Creek (see figures 17 and 18) and the western riparian unit along the main stem of Oil Creek below it's confluence with Rattlesnake Creek (see figures 19 and 20).

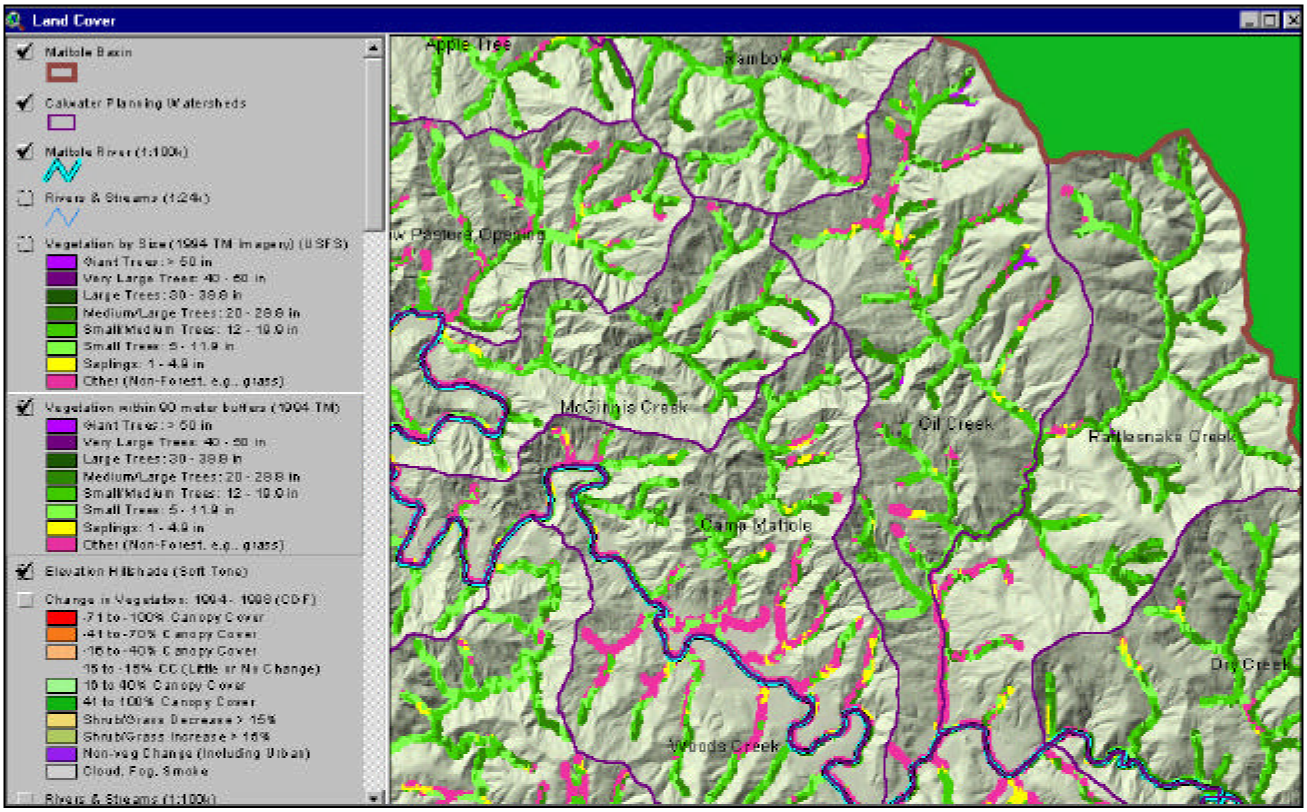

Figure 16: Riparian Vegetation Pattern of the Northern Subbasin.

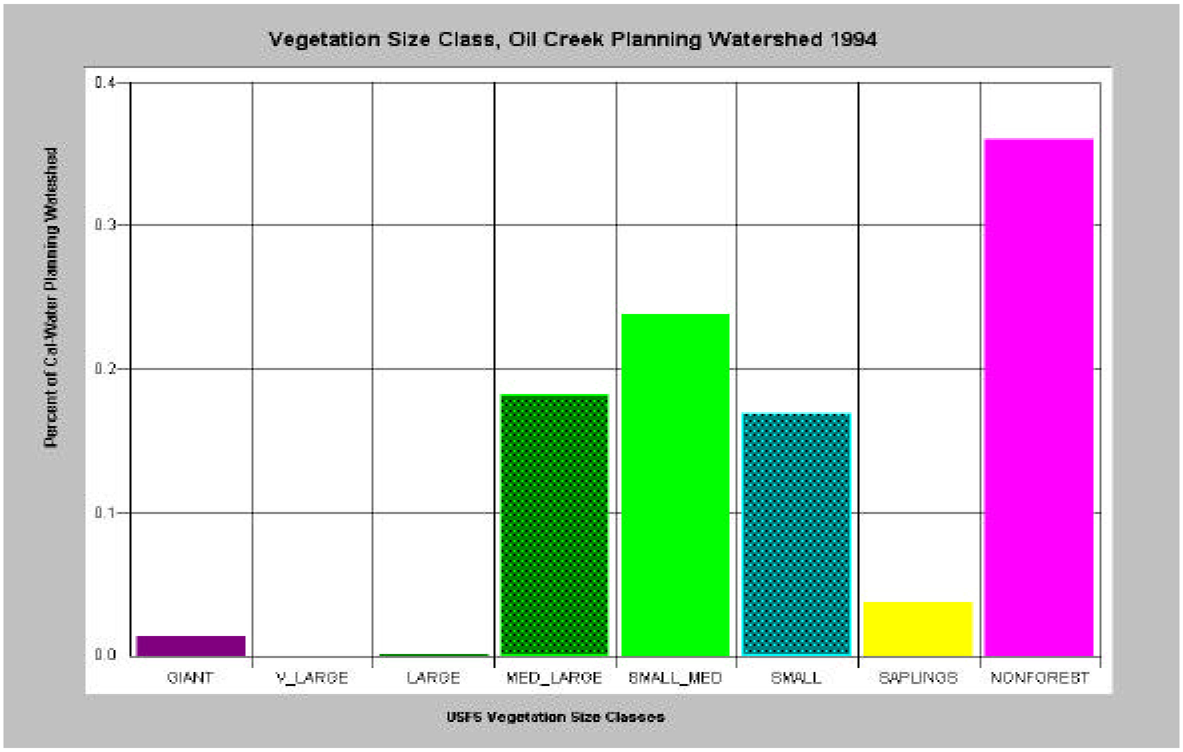

Figure 17: Vegetation Size Class, Oil Creek Planning Watershed 1994.

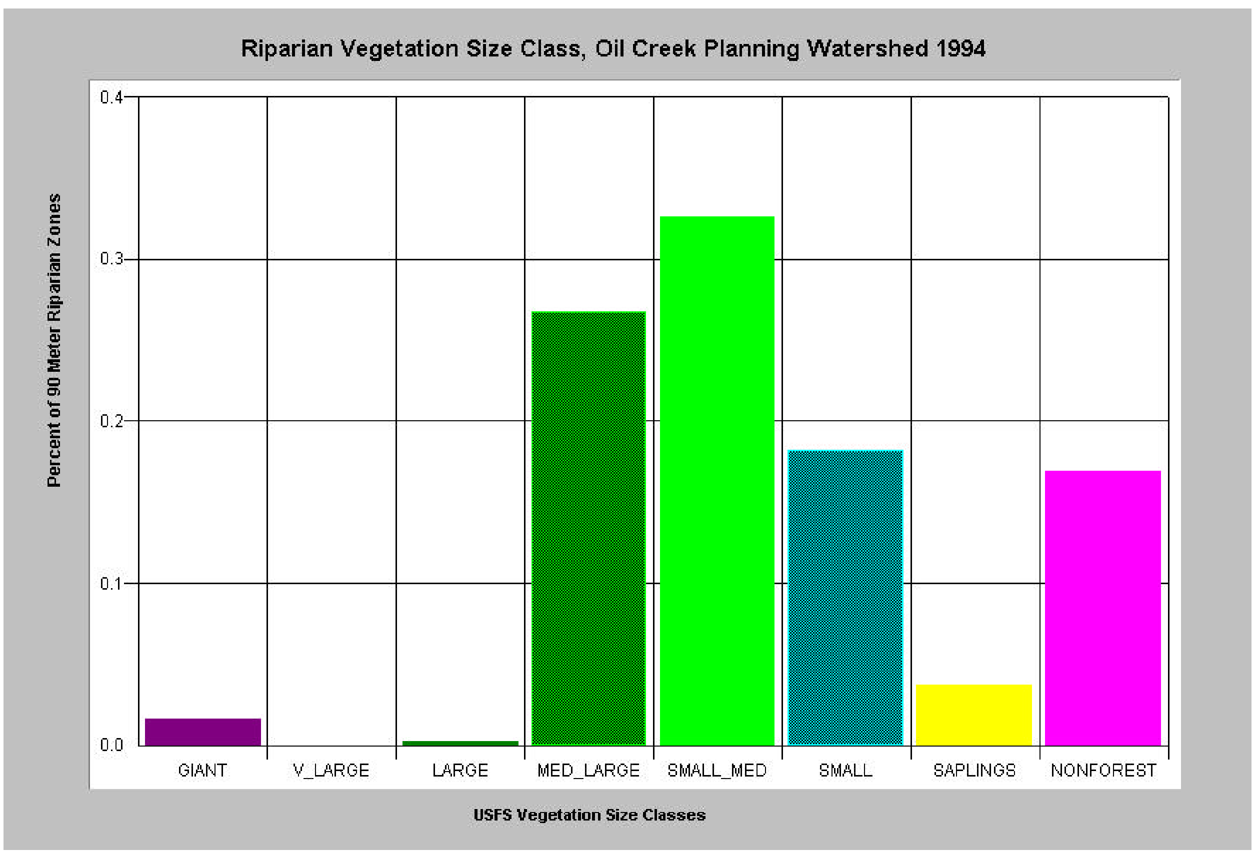

Figure 18: Riparian Vegetation Size Class, Oil Creek Planning Watershed 1994.

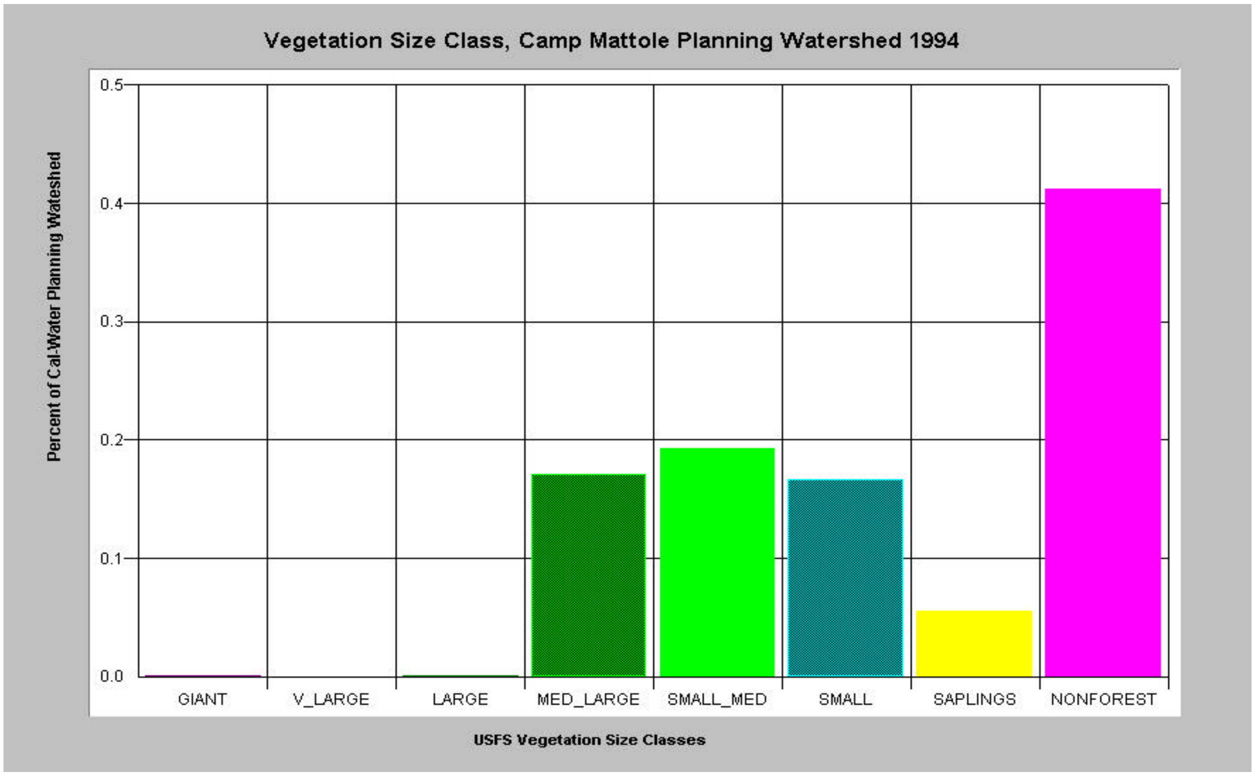

Figure 19: Vegetation Size Class, Camp Mattole Planning Watershed 1994.

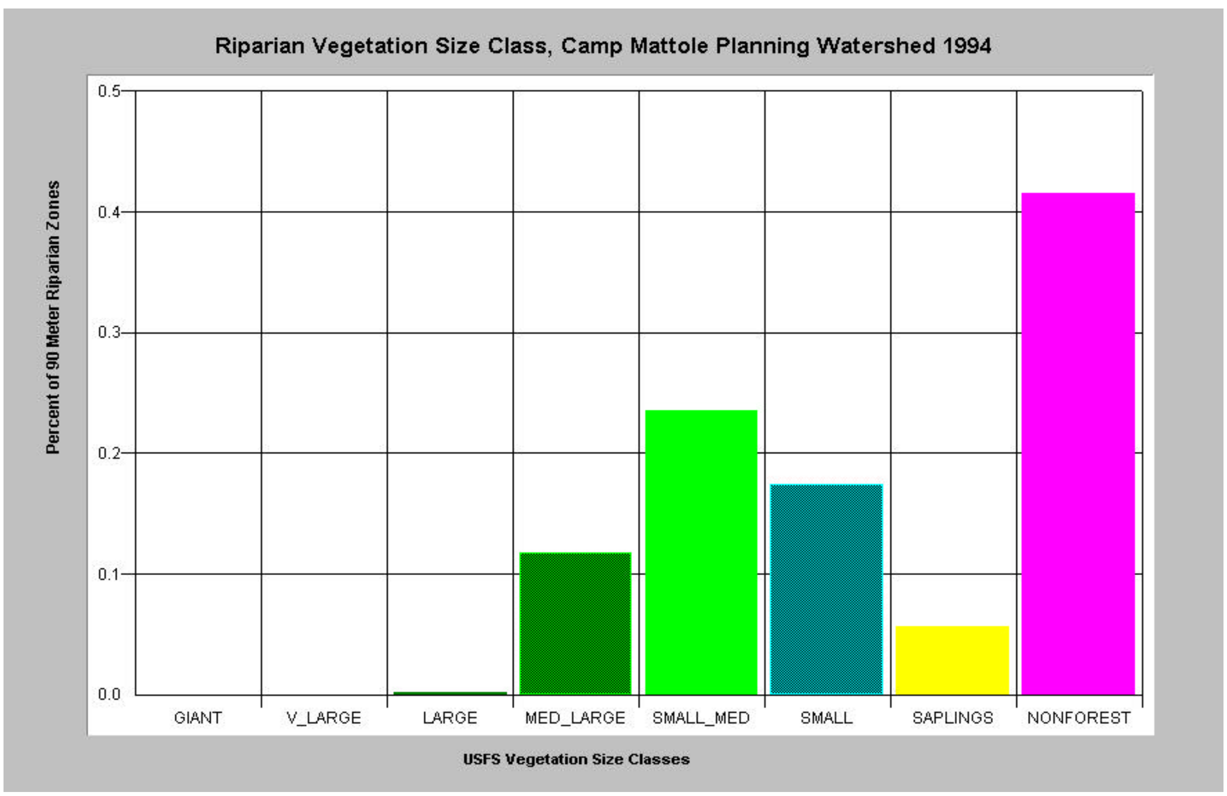

Figure 20: Riparian Vegetation Size Class, Camp Mattole Planning Watershed 1994.

Fish History and Status

Based on limited sampling, mainly in the Upper North Fork drainage, coho have not been found. Four years of electrofishing in three streams (Oil, Green Ridge, and Rattlesnake creeks) show stable multi-year class populations of juvenile steelhead

Fish Habitat Relationship

The subbasin supports populations of chinook salmon and steelhead. In fact, the upper tributary reaches of the Upper North fork has relatively dense, multi-year class juvenile steelhead rearing populations based upon the DFG monitoring efforts from 1992-1995. This occurs in spite of very warm summer water temperatures due, it seems, to a plenitude of cold springs, seeps, and small tributaries that provide thermal refugia. Coho were once here, but have not been found recently.

Fish Passage Barriers

Two stream crossings were surveyed in the Northern Subbasin as a part of the Humboldt County culvert inventory and fish passage evaluation conducted by Ross Taylor and Associates (2000). Conklin Creek Road and Chambers Road both have culverts on East Mill Creek. The culvert on Conklin Creek Road was found to be a temporary salmonid barrier while the culvert on Chambers Road was not found to be a salmonid barrier (Table X.). Priority ranking of 67 culverts in Humboldt County for treatment to provide unimpeded salmonid passage to spawning and rearing habitat placed the culvert on Conklin Creek Road at rank 17 and the culvert on Chambers Road at rank 36. Criteria for priority ranking included salmonid species diversity, extent of barrier present, culvert risk of failure, current culvert condition, salmonid habitat quantity, salmonid habitat quality, and a total salmonid habitat score. The culvert on Conklin Creek Road is scheduled for improvements in 2002 (G. Flosi, personal communication).

Table 15 Culverts surveyed for barrier status in the Northern Subbasin (Taylor, 2000; G. Flosi, personal communication).

Stream Name	Road Name	Priority Rank	Barrier Status	Upstream Habitat	Treatment
East Mill Creek (1)	Conklin Creek Road	17	Temporary barrier. A steep gradient and excessive under sizing creates a temporary velocity barrier for adults (which is probably a total barrier to juveniles). Additionally, railroad rails probably contribute to passage problems – the rails break up the slope in steps, yet there is no depth for fish to leap out of when ascending. Woody debris pinned across the culvert also increases velocity and turbulence at inlet.	Approximately 2.7 miles of fair salmonid habitat.	Funded and scheduled for improvement in 2002
East Mill Creek (2)	Chambers Road	36	Not a barrier. The culvert is set below grade with natural channel bottom. Even at low flow there is a backwatering of the downstream end of the culvert.	Approximately 2.0 miles of fair salmonid habitat.	None proposed at this time

Salmonid Habitat Graphical

The Department of Fish and Game conducted salmonid habitat surveys in 51 tributary streams of the Mattole watershed in the period 1991-1999 following methods described by the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1991, 1998). Of the several stream attributes collected, those used in the NCWAP Ecological Management Decision Support system model in assessing stream reach conditions of salmonid habitat are canopy cover, embeddedness, percent pools, pool depth, and pool shelter. These habitat attributes are presented in the Analysis and Results by Subbasin section of this report as graphical bar charts. The bar charts were prepared in KRIS Mattole and present summary data for each surveyed stream. All the habitat attributes presented in bar charts are interpreted using the response curves operating in the EMDS Stream Reach Model. The EMDS values used for assigning these ratings are given in Table EMDS 4, in this report's Program and Introduction Section.

These graphics present the same data used in the EMDS Stream Reach Model, but summarize those data for an entire stream where more than one reach was surveyed. Of the Mattole streams surveyed, 12 had two reaches surveyed, three had three reaches surveyed, two had four reaches surveyed, and one had five reaches surveyed. Four streams where surveys covered less than 1000' feet were not included in the bar charts due to concerns about low sample size.

Five charts are presented in the same order and format in four Subbasin Results sections of this report. **Chart 1** (e.g. Figure NH1, Figure WH1) presents the relative percent conifer canopy, deciduous canopy, and open canopy (no canopy) above surveyed streams. Canopy cover, and the relative cover by coniferous versus deciduous trees were measured at each habitat unit during DFG stream surveys. Chart 1 presents averages weighted by unit length to give the most accurate representation of the percent of a stream under these types of canopy. As described in the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% is considered fully suitable, and total canopy less than 50% is fully unsuitable for contributing to cool water temperatures that support salmonids.

Chart 1 is useful for interpreting the condition of riparian canopy with respect to vegetation type. The near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature in contact with the stream, which is an important factor in determining stream water temperature. The EMDS watershed scale model considers the status of the nearstream forest component. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter.

Larger streams generally have more open canopy and deeper pools than small streams. This is partially a function of wider stream channels and greater stream energy due to higher discharge during storms. The charts in this section of the report list streams on the vertical axis in descending order by drainage area (largest at the top) in order to allow some resolution on this size factor. By such a presentation, one would expect a trend in canopy cover and pool depth values. Deviations from the expected trend in canopy or pool depth may indicate streams with more suitable or unsuitable canopy or pool depth conditions relative to other streams of that subbasin.

Chart 2 (e.g. Figure NH2) presents cobble embeddedness categories as measured at every pool tail crest. The EMDS Reach Model considers cobble embeddedness greater than 50% to be somewhat unsuitable and 100% to be fully unsuitable for the survival of salmonid eggs and embryos. Chart 2 is useful for examining the distribution of embeddedness values encountered in a stream, and among steams within the subbasin.

Habitat categories by percent survey length are described in **Chart 3** (e.g. Figure NH3) showing the abundance of overall pool, flatwater, and riffle habitats, as well as the percent of a surveyed stream reach that is de-watered, if any, at the time of the survey. During their life history, salmonids require access to all of these types of habitat. EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable.

Chart 4 (e.g. Figure NH4), illustrates the percent length of a survey composed of deeper, high quality pools. The amount of pool habitat of sufficient depth to be fully suitable for anadromous salmonids is considered in the EMDS Reach Model as the percent of primary pools determined by a range of pool depths, depending on the order (size) of the stream.

Generally, a reach must have 30 – 55% of its length in these high quality pools for its stream class to be in the suitable ranges (EMDS Table 4).

Chart 5 (e.g. Figure NH5) shows pool shelter rating, which illustrates relative pool complexity, another component of pool quality. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of thirty. The range from 100 to 300 is fully suitable.

The surveyed stream reaches of the Northern Subbasin show percent canopy levels that are rated in the EMDS as somewhat unsuitable or worse for maintaining water temperature to support anadromous salmonid production (Figure NH1). Sulphur Creek and its tributary have the highest canopy cover values of Northern Subbasin, and the highest percent conifer canopy among all Mattole streams surveyed. Embeddedness values in the Northern Subbasin are moderately unsuitable or completely unsuitable for developing salmonid eggs and embryos with the exception of Sulphur Creek (somewhat suitable) and its tributary (somewhat unsuitable). Figure NH2 illustrates how stream reaches rated as unsuitable overall may actually have some relatively suitable spawning gravel sites distributed through the stream reach. Most of the surveyed Northern Subbasin streams have less than 20% pool habitat by length (Figure NH3). Rattlesnake Creek has the most pool habitat with maximum depth greater than 3 feet, but this measures only 6% of total pool length (Figure NH4). The EMDS rates pool quality in all Northern Subbasin streams as moderately or completely unsuitable for supporting anadromous fish populations. Pool shelter ratings, according to the EMDS stream reach model, range from somewhat unsuitable to completely unsuitable (Figure NH5).

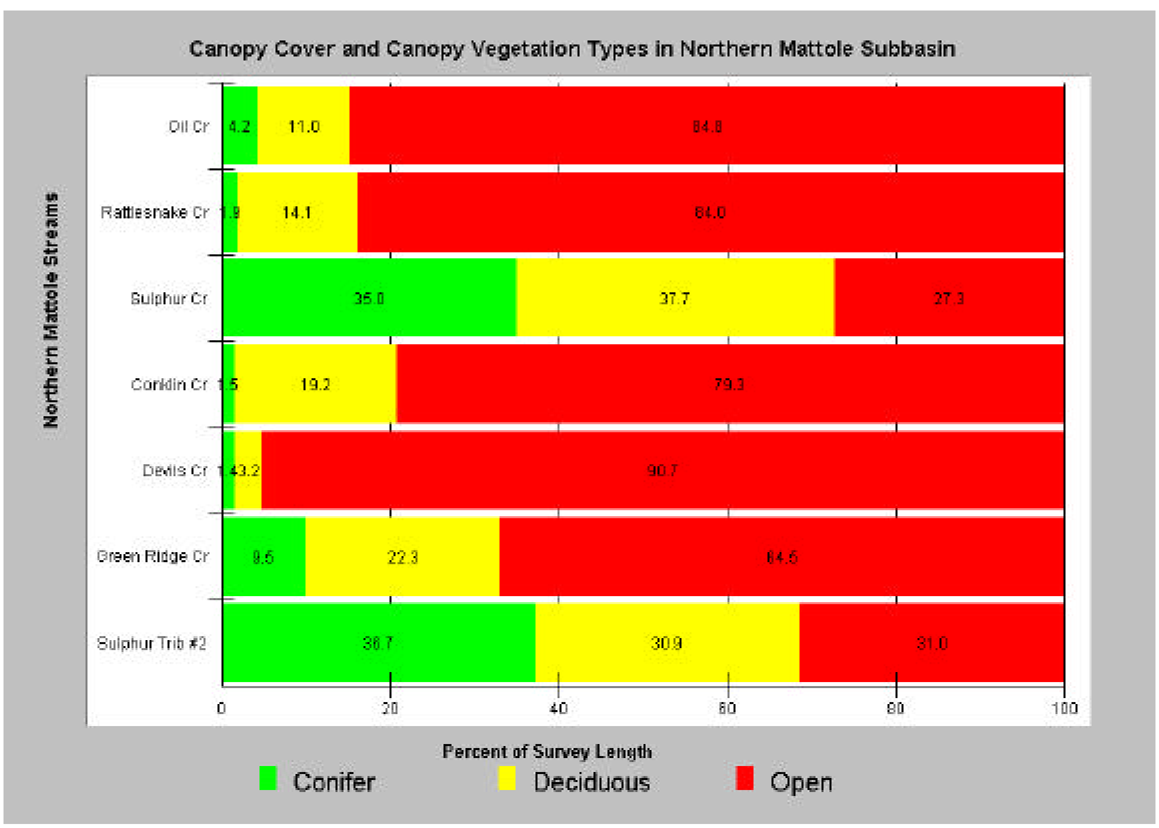

Figure NH1: Canopy cover and canopy vegetation types from DFG stream surveys of the Northern Mattole Subbasin. Chart from KRIS Mattole.

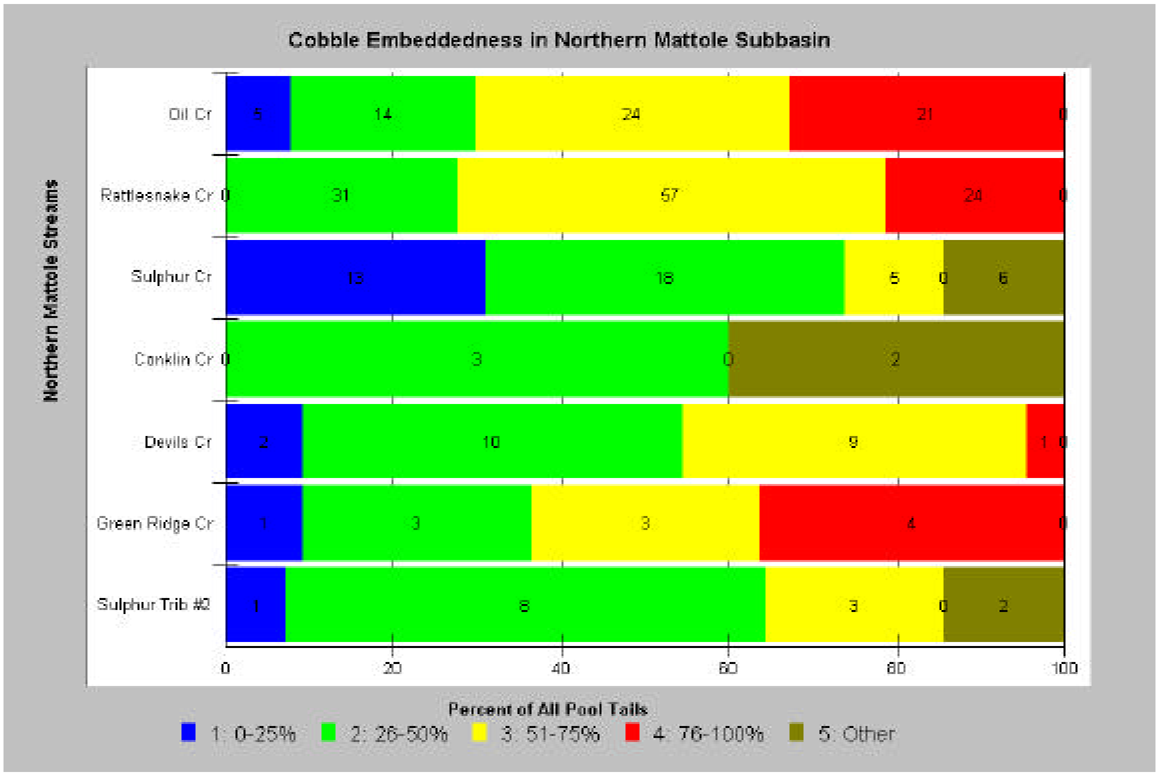

Figure NH2: Cobble embeddedness from DFG stream surveys of the Northern Mattole Subbasin. Substrate embeddedness categories in excess of 50% are considered by EMDS to be somewhat unsuitable to fully unsuitable for the survival of salmonid eggs and embryos. Chart includes those pool tails deemed unsuitable for spawning due factors other than embeddedness (e.g., a log sill, etc., Category Five). Chart from KRIS Mattole.

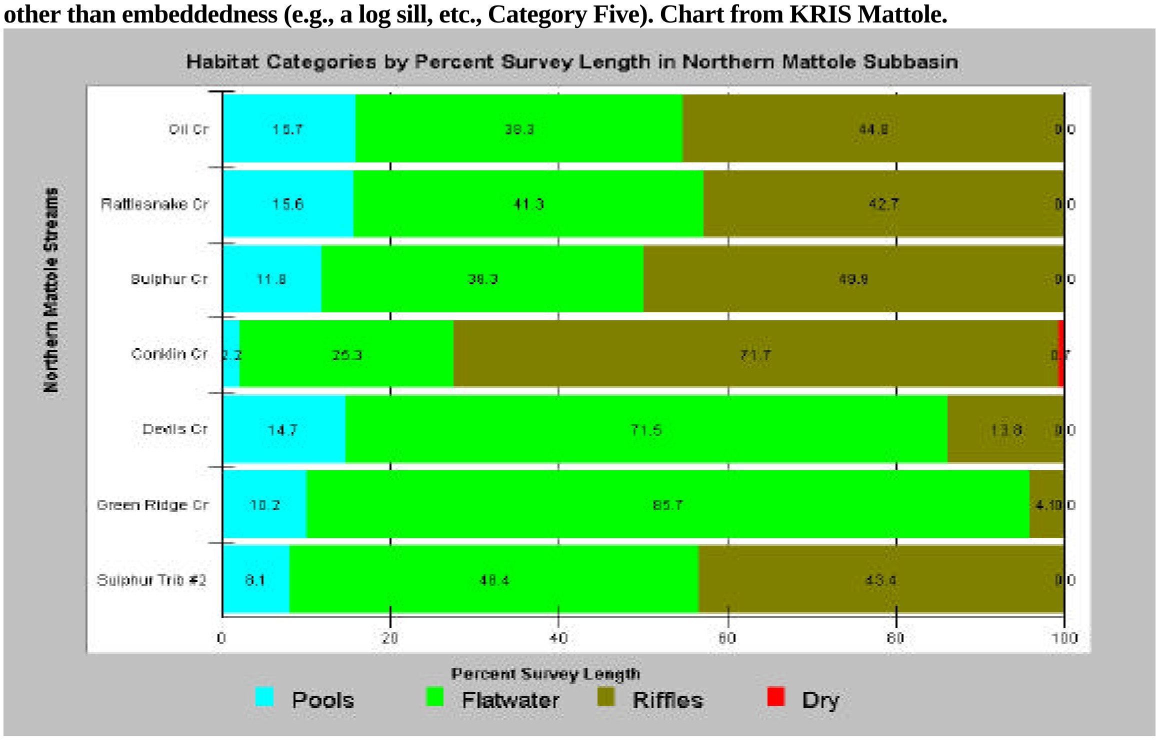

Figure NH3: Habitat categories by percent survey length from DFG stream surveys of the Northern Mattole Subbasin. Chart from KRIS Mattole.

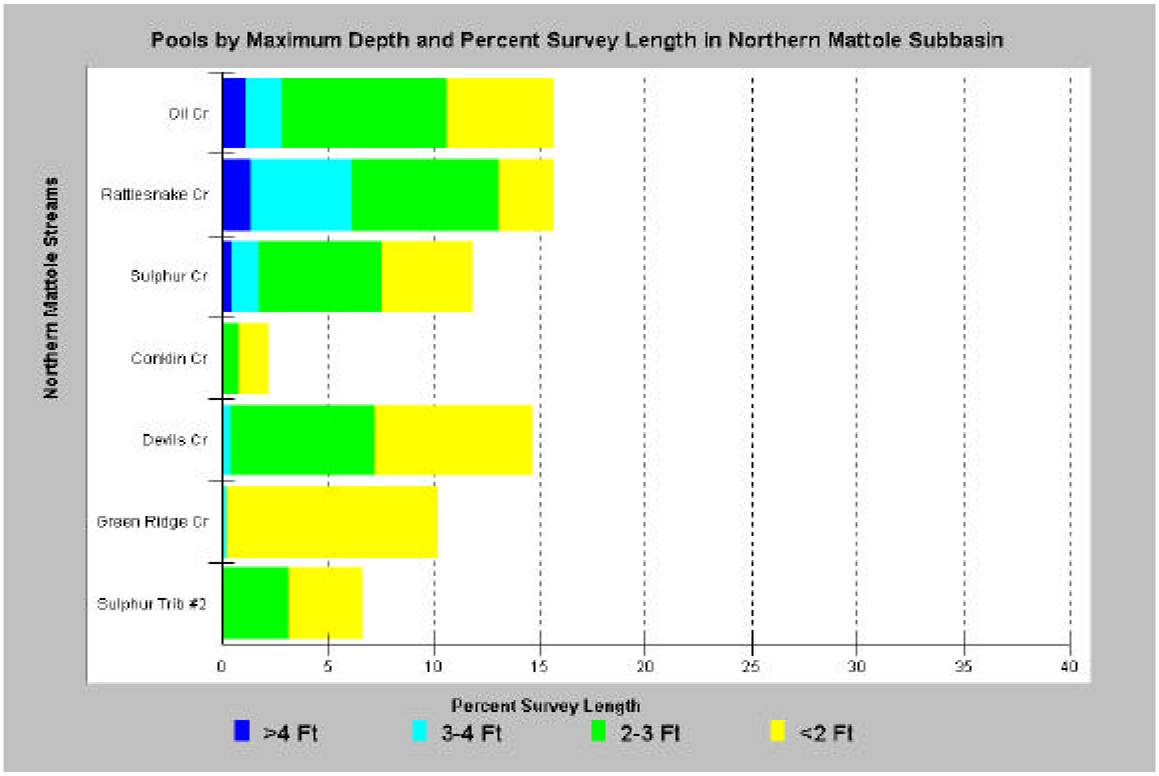

Figure NH4: Pools by maximum depth and percent survey length from DFG stream surveys of the Northern Mattole Subbasin. Portrayed values sum to the length of percent pool habitat in Figure NH3. Chart from KRIS Mattole.

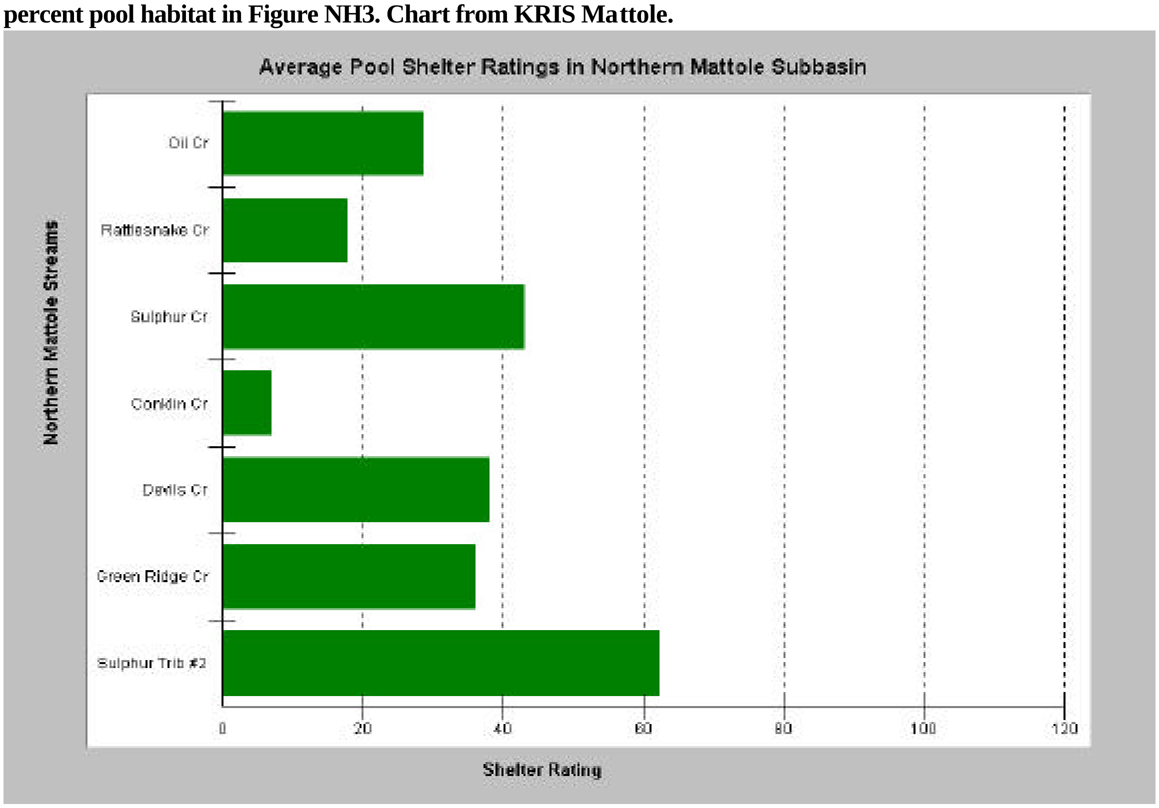

Figure NH5: Average pool shelter ratings from DFG stream surveys of western Mattole tributaries. An EMDS rating in the range 100-300 is considered fully suitable (X-axis is truncated here). Chart from KRIS Mattole.

Subbasin Trends

The trends for several factors within the Mattole River tributaries in the Northern subbasin can be summarized as follows. The size and density of the riparian zone woody vegetation in timberlands will increase over time due to timber harvesting plan regulations. Lands owned by the Pacific Lumber Company have additional restrictions that are part of their Habitat Conservation Plan. There is no trend that can be inferred for riparian areas that are grazed by livestock. Humboldt County requires new construction set-backs from watercourses that will help preserve existing riparian vegetation, but the clearing of vegetation by landowners as part of rural residential living is not regulated outside of the Coastal Zone. Trends for riparian zones bordered by or containing roads are also unclear. It is possible that some roads may be abandoned and riparian vegetation re-established, but many of the roads are County roads, lead to streamside County roads, or access home sites. Riparian vegetation may be sacrificed in road maintenance activities, both regular and storm induced.

The number of roads within the watershed can be expected to increase as timberlands are harvested for the first time since the application of current Forest Practice rules. These rules and current practices generally require road systems located high on the slope unlike earlier timber harvest and transportation systems that established roads low on the slopes, often near streams.

The short time period of stream temperature data results does not allow for any trend analysis. There is no data on suspended sediment.

The fluvial geomorphology is characterized by the relatively highest percentage of disturbed channel and stream bank erosion of the Mattole subbasins. While most of the Northern subbasin remained in a nearly static condition from 1984-2000, certain areas of the Joel Flat planning watershed appears to have shown a significant decrease in disturbed channel. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one hundred year return events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Subbasin Issues

- Land use practices on steep and/or unstable slopes should be conducted in accordance with guidelines and recommendations in DMG Note 50.

- Roads – There is concern over abandoned roads, new road construction, and road maintenance issues related to landsliding and sediment input. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to supply sediment.

- There is no road assessment program in this planning basin.

- If future sub-division is proposed, the county imposed 40-acre minimum parcel sub-division ordinance with the preponderance of unstable slopes and sediment issues will need to be addressed. However, it is felt that sub-division of land is not as much of an issue in this area.

- Water chemistry – No data is available on pH, DO, nutrients, etc.

- Water temperature data suggests that summer high temperatures exceed optimal conditions for salmon throughout much of this planning basin.

- Instream sediment data is needed. Based upon a few samples from Oil and Rattlesnake creeks there is an indication that fine sediments may be approaching or exceeding levels that are considered harmful to salmonid populations.

- Canopy cover is below EMDS target values. Instream movement of sediment appears to causing channel widening, leading to less stream canopy cover.

- Large woody debris recruitment potential is very poor overall due to naturally occurring geologic conditions. Land use practices may be exacerbating the naturally occurring adverse conditions.

- Aquatic macro-invertebrate productivity – Very limited data is available in this planning basin to quantify potential food sources available to fish.

- In-stream habitat diversity and complexity, based on surveys available, appears to be insufficiently diverse. Inadequate pool depth, and a lack of escape cover and large woody debris have contributed to a simplification of instream fish habitat.

- Wildlife/Plants -- Inadequate information exists to assess the status and trends of flora and fauna, including invasive species. Local landowners in the area report that coyotes are prevalent and uncontrolled.

- Recreation – There is little public access other than county roads, so opportunities for recreational activities are generally limited to public roadways along the mainstem Mattole. Fishing for winter steelhead is very popular, although it is strictly a catch and release fishery.

- Hatchery activities are non-existent in this planning basin.

- Fish population information is poor due to access issues for surveys. In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

Subbasin Issue Synthesis

Working Hypothesis 1: ***Summer stream temperatures in many subbasin tributaries are not within the range of temperatures that fully support healthy anadromous salmonid populations.***

Supportive Findings:

- Summer stream temperatures exceed levels fully supportive of salmonids:

- MWAT for 0.5 miles upstream in the Lower North Fork Mattole River was 69.7ºF in 1998. It is likely that for some unknown distance upstream from the thermograph location, and more likely for the 0.5 miles that the Lower North Fork Mattole River flows to the mainstem from the thermograph, this reach probably was not fully supportive of coho salmon since this temperature is well above their preferred MWAT range of 50-60ºF.

- MWATs for 2.0 miles upstream in the Upper North Fork Mattole River were 70.1, 71.1, and 69.8ºF in 1997, 1998, and 1999 respectively. As such, it appears that the Upper North Fork Mattole River at this point, and probably for some distance upstream may not be suitable habitat for coho salmon rearing.

- Low canopy levels appear to be a function of both riparian cover depletion from land use and stream widening due to high sediment inputs, especially in 1964.

- Air photo analysis indicates that historic timber harvest has reduced canopy closure in near stream areas.

- Air and historic photo documentation, after the 1955 and 1964 floods, indicate significant changes in many channels in the Northern subbasin.

Working Hypothesis 2: ***Aggradation from fine sediment in some stream channels of this subbasin has reduced channel diversity needed to fully support anadromous salmonid populations and has compromised salmonid health.***

Supportive Findings:

- Field surveys indicate that sediment delivery has had an adverse and long lasting impact to salmonid habitat in the Northern subbasin:

- Air photo analysis indicates that the lower reaches of the large tributaries to the Mattole River are highly aggraded with fine sediment.

- Late summer field observations indicate that aggradation and channel widening have likely contributed to a loss of surface stream flow.

Contrary Findings:

- V* for Conklin Creek during 2000 was 0.27, which would indicate a low to moderate supply of sediment from upslope upstream sources.

Working Hypothesis 3: ***A lack of large woody debris in some stream reaches of this subbasin has reduced channel diversity needed to fully support anadromous salmonid populations and has compromised salmonid health.***

Supportive Findings:

- Field observations indicate that amounts of instream large woody debris in the mainstem Mattole River and its tributaries in the Northern subbasin are low.

- Public input and historic photos indicate that historic timber harvest throughout the Northern subbasin tributaries frequently removed large conifer vegetation down to the stream bank, resulting in a reduction of the available recruitment supply of large woody debris.

- The DFG has sponsored large woody debris removal projects in the past.

- Riparian vegetation is in size classes that are not expected to contribute large woody debris in significant quantities in the near future.

Recommendations:

1 Ensure that near stream areas are managed to reduce solar radiation and moderate air temperatures in order to reduce heat inputs to the Mattole River and its tributaries.

2 Monitor 24 hour summer water and air temperatures to detect trends using continuous monitoring thermographs.

3 Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management and livestock management techniques to hasten the development of denser and more extensive riparian canopy.

4 Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance and resultant sediment yield.

5 Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.

6 Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.

7 Based upon the latest science on placement of large woody debris instream channels managers in the Northern subbasin should work to improve channel structure and function for salmonids.

8 Develop alternatives to unrestricted stock access to aquatic riparian areas where livestock damage occurs.

9 Conduct sediment grain size distribution studies to allow for the evaluation of potential linkages between fine-grained materials from upland terrain and fine-grained materials in stream reaches. The goal would be to determine the general distribution of sediment grain sizes delivered to the channel and even possibly the timing of channel response to changed sediment inputs (refer to April 2001 Draft DOC/DMG NCWAP Manual, pg 21).

10 Continue efforts such as road improvements and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.

Eastern Mattole Subbasin

Introduction

The Eastern subbasin is located between Honeydew Creek (River Mile 26.5) and Bridge Creek (River Mile 52.1) along the eastern side of Wilder Ridge, and the Mattole mainstem above Bear Creek, for a distance of about 25.6 river miles (see map on following page). There are fifteen perennial streams that drain a watershed area of 79 square miles. The DFG has recently surveyed 22.2 miles of the subbasin's anadromous reaches. Elevations range from 344' at Honeydew Creek to approximately 2,300' in the headwaters of the tributaries.

Climate

The Eastern subbasin has the highest rainfall averages, ranging from 85 inches near Thorn Junction to 115 inches in the hills east of Honeydew. Temperatures are typical of other inland areas of California with sub-freezing winter temperatures and above 100° F summer temperatures.

Hydrology

The Eastern subbasin is made up of six complete Calwater Units (see map on the following page). There are 54.0 perennial stream miles in 15 perennial tributaries in this subbasin (see table 13). Thirteen of these tributaries have been inventoried by the DFG. There were 18 reaches, totaling 31.1 miles in the inventory surveys. The inventories included channel and habitat typing, and biological sampling.

In their inventory surveys, the DFG crews utilize a channel classification system developed by David Rosgen (1994) and described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

In the Eastern subbasin, there were three type A channels, totaling 2.3 miles; eight type B channels, totaling 16.4 miles; one type C channel, totaling 0.5 miles; and five type F channels, totaling 11.7 miles. Type A stream reaches are narrow, moderately deep, single thread channels. They are entrenched, high gradient reaches with step/pool sequences. Type A reaches flow through steep V- shaped valleys, do not have well-developed floodplains, and have few meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders. Type C stream reaches are wide, shallow, single thread channels. They are moderately entrenched, low gradient reaches with riffle/pool sequences. Type C reaches have well-developed floodplains, meanders, and point bars. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders (Flosi, et al., 1998).

Geology

The geology of the Eastern subbasin encompasses the widest range of bedrock types and structure in the watershed, including portions of the Coastal terrane, Yager terrane, and Coastal belt mélange, along with the fault zones that form the boundaries between the terranes. Correspondingly, relative slope stability and geomorphology vary widely within the subbasin. In general, the bedrock may be described as relatively intact and stable material that is locally interrupted by northwest-trending zones of sheared mélange and faulting where the rock is much weaker and susceptible to weathering. As with other areas in the watershed, grasslands areas impacted by earthflows, soil creep, and excessive gully erosion tend to develop in the mélange matrix and fault/shear zones. These conditions are found along a broad shear zone that extends to the southeast from Honeydew, along Pringle Ridge and on across the Mattole river near Duncan Creek. Similar conditions are found in the upper reaches of Mattole Canyon Creek and Blue Slide Creek where several fault zones and Coastal belt mélange are present. Steep forested slopes locally impacted by active debris slides and occasional large, deep-seated landslides that are for the most part dormant are more typical in the areas of more intact bedrock in the subbasin.

Insert Eastern Subbasin Map here.

Table 16 Surveyed Streams with Estimated Anadromy in the Eatern Subbasin

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
Dry Creek	Y	1.6	3.0	1	F4
Middle Creek	Y	1.4	2.1	1	B4
Westlund Creek	Y		3.1		
	Y	2.3		1	B4
	Y	0.9		2	A4
Gilham Creek	Y	1.9		1	B4
	Y	0.7		2	A3
Duncan Creek	N				
Fourmile Creek	Y		3.1		
	Y	0.5		1	C4
	Y	0.7		2	A4
Sholes Creek	Y	4.0	2.0	1	B4
Harrow Creek	Y	0.2	0.2	1	B3
Grindstone Creek	Y	2.6	0.3	1	B4
Mattole Caynon	N		6.0		
Blue Slide Creek	Y	6.3	7.0	1	F4
Fire Creek	Y	2.0		1	F4
Deer Lick Creek	N				
Eubanks Creek	Y		3.2		
	Y	3.0		1	B1
	Y	0.3		2	B4
Sinkyone Creek	N				
McKee Creek	Y		2.1		
	Y	0.7		1	B3
	Y	1.5		2	F4
Painter Creek	Y	0.3	1.1	1	F4

Vegetation

Section under development.

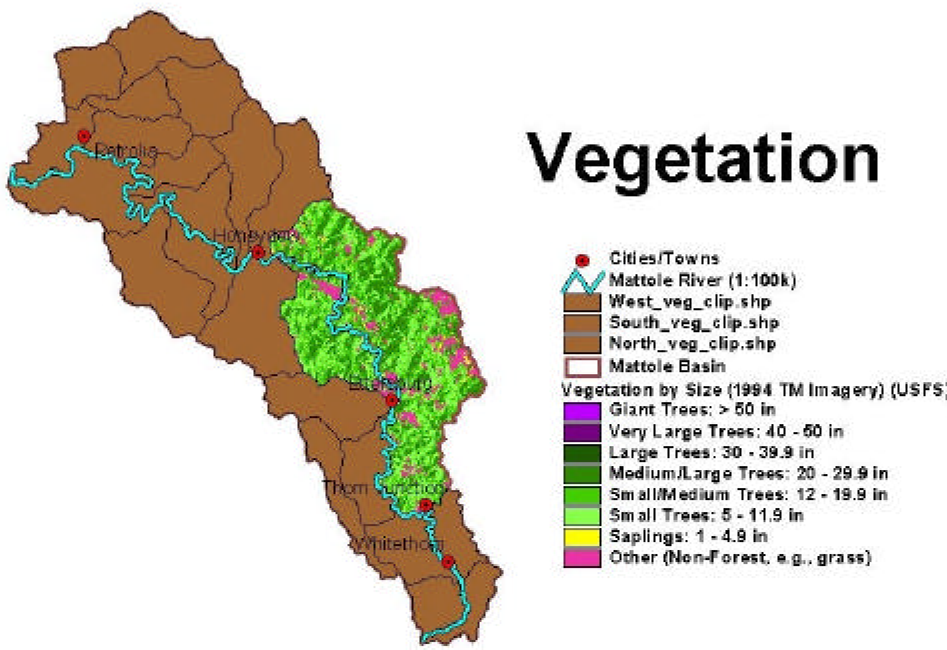

Figure 21: Vegetation of the Eastern Subbasin.

Land Use

The watershed is largely subdivided into back-to-land homesteads (see figure 22). About a third of the area is managed for timber production and cattle ranching. The town of Honeydew is located at the downstream end of this subbasin near the confluence of Honeydew Creek and the Mattole River. The hamlets of Ettersburg and Thorn Junction are also located in this subbasin. Controversy over timber harvest issues have occurred in the past (Table 12), focused on stands near Gilham Butte, but there is some citizen interest to establish a wildlife and forestland corridor linking some lands in the South Fork Eel River, connecting to Humboldt Redwood State Park, through the Gilham Butte protected lands and across the basin to King Range National Recreation Area in the western planning basin. The track of this corridor would bisect the middle of this basin as well as the largest remaining ranch, thus a large portion of the basin would, for the mo st part, be unavailable for sub-division.

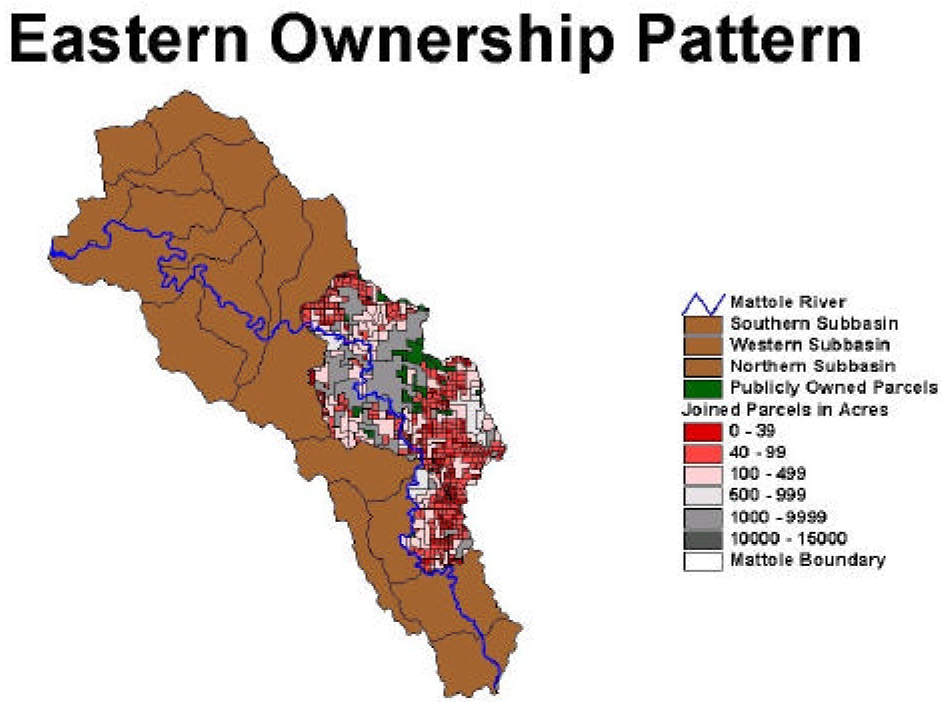

Figure 22: Ownership Pattern of the Eastern Subbasin.

Table 17: Timber Harvest History, Eastern Mattole Subbasin.

TIMBER HARVEST HISTORY - EASTERN MATTOLE SUBBASIN		
	Total Acres	Percent of Area
Harvested 1945-1961	21,431	42%
Harvested 1962-1974	7,639	15
Harvested 1975-1983	3,288	7
Harvested 1984-1989	560	1
Harvested 1990-1999	1,928	4
Harvested 2000-2001 (partial)	0	0

The Eastern subbasin contains an extensive and largely un-surfaced road system to service the rural sub-divisions in the subbasin. These roads are used year round by residents, further elevating the already high production rates of fine sediment into the stream network. This condition is deleterious to stream habitat for salmonids. These impacts, especially in the depositional, lower reaches of the tributaries adversely affects summer juvenile rearing and created less than ideal spawning conditions for adult salmonids.

Fluvial Geomorphology

The fluvial geomorphology of the Eastern subbasin is characterized by a high percentage of disturbed channel in site specific areas, including portions of streams within the Sholes Creek, Dry Creek, Westland Creek, and Mattole Canyon planning watersheds. Table 2 (still under development) illustrates the range in percent disturbed channel for the 1984 and 2000 aerial photographs. The Eastern Mattole subbasin offers the best example of a decrease in disturbed channel from 1984 to 2000. Sholes Creek is noteworthy because in certain areas it has shown a 50 percent decrease in disturbed channel. The length and number of areas of stream bank erosion are not as numerous as in the northern subbasin.

A large area of high sediment deposition was observed along Dry Creek immediately up stream from a large slide. This area of deposition has been attributed to backwater effects along Dry Creek related to this large persistent slide acting as a hydrologic point of constraint. The mouth of Mattole Canyon is another location, which has been a long-term area of sediment accumulation (2000, 1984, and 1942 air photos). This can be attributed to weak rocks and numerous slides up canyon and a change of gradient near the area of deposition.

Aquatic/Riparian Conditions

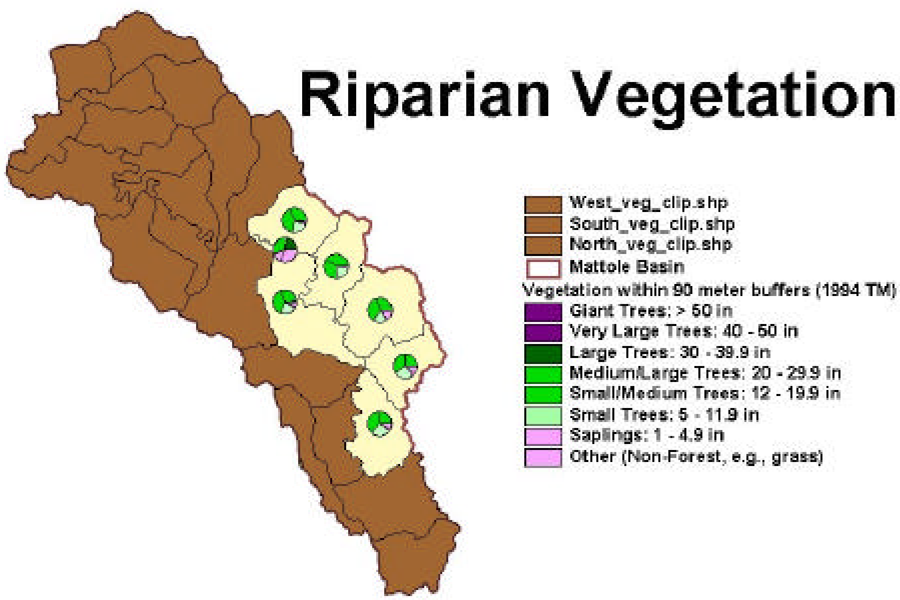

Figure 23: Riparian Vegetation of the Eastern Subbasin.

The majority of the riparian vegetation in this subbasin in the small to medium tree sizes (Figure 23). As with other watersheds, this generally reflects past harvest history. The Westlund Creek planning watershed has had almost no timber harvesting since 1983 (Figures 24 and 25). Sholes Creek, on the other hand, has had the largest percentage of post 1983 harvesting for the subbasin (Figures 26 and 27). There is a small increase in the larger size classes but no analysis have been run to see if the differences are real or statistically significant.

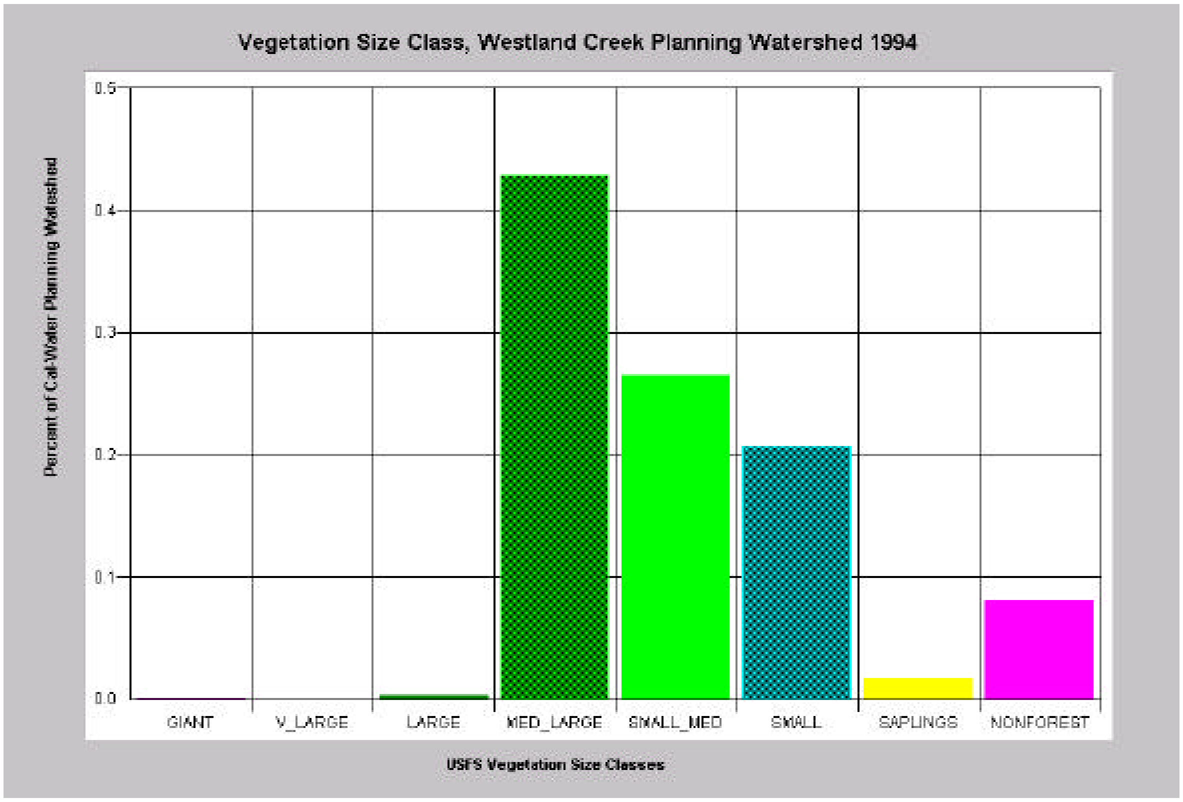

Figure 24: Vegetation Size Class, Westland Creek Planning Watershed 1994.

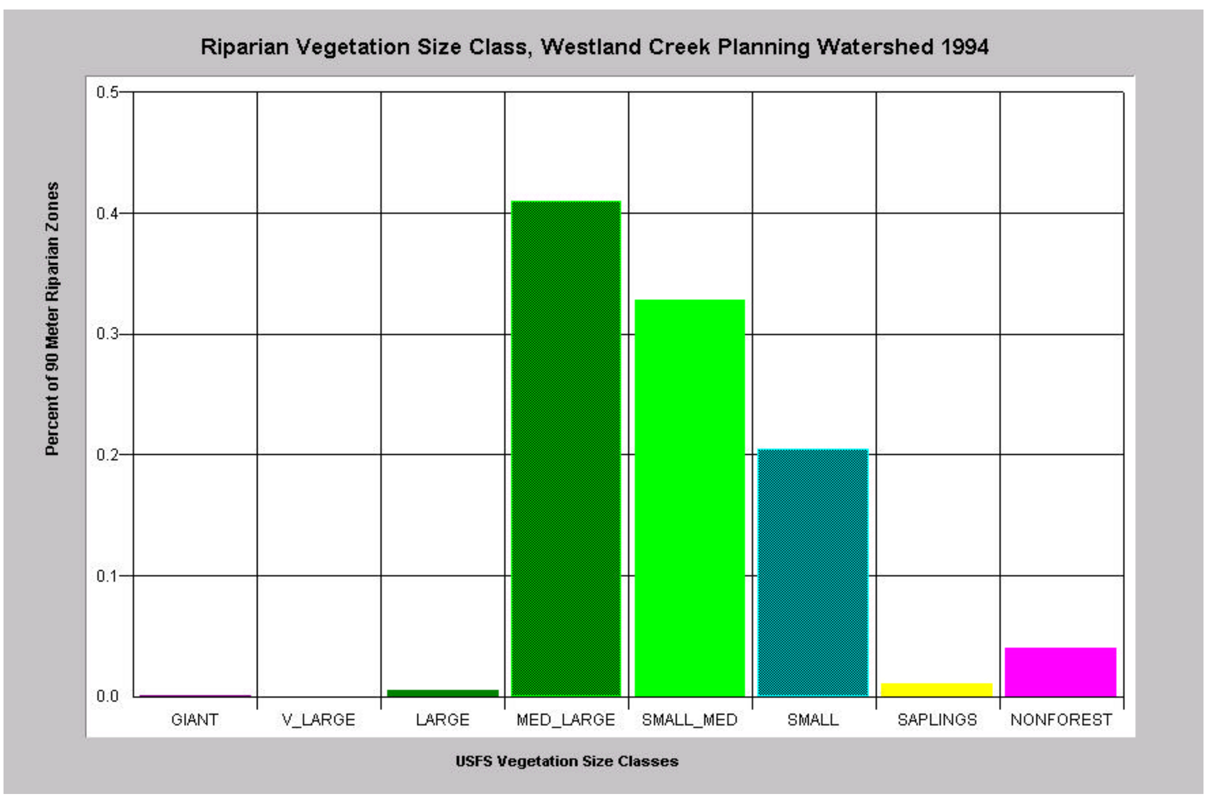

Figure 25: Riparian Vegetation Size Class, Westlund Creek Planning Watershed 1994.

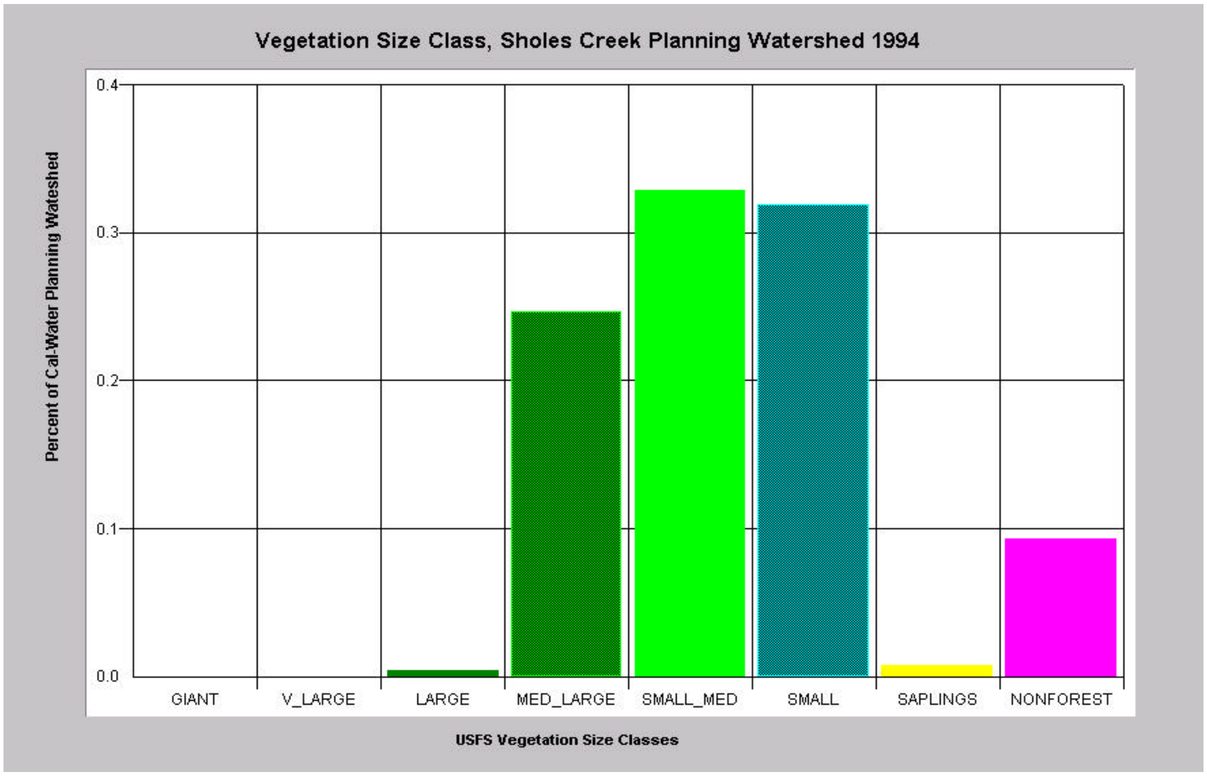

Figure 26: Vegetation Size Class, Sholes Creek Planning Watershed 1994.

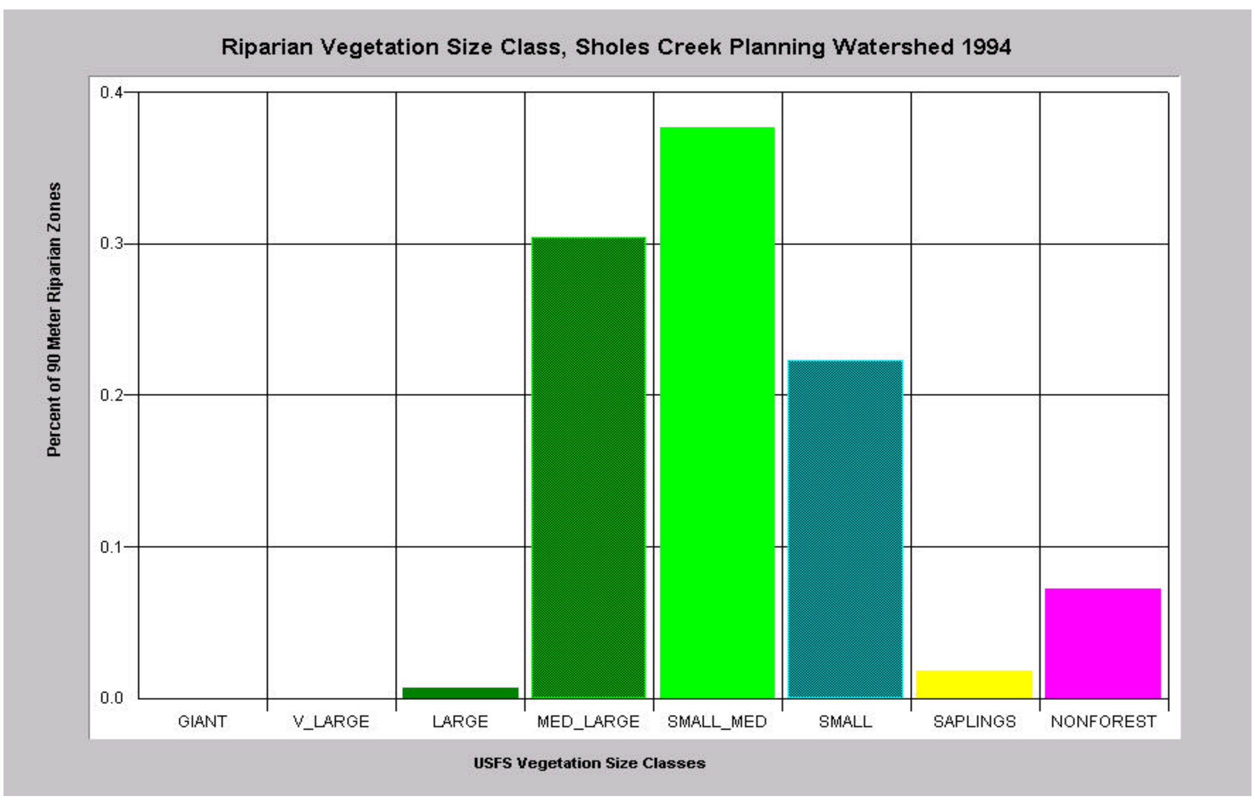

Figure 27: Riparian Vegetation Size Class, Sholes Creek Planning Watershed 1994.

Fish History and Status

Based on limited fish sampling, few coho and no Chinook have been found in tributary surveys. In 2001, the DFG Coho Assessment staff found coho in two streams in the subbasin. Steelhead populations are well distributed and are represented with diverse age classes. Additional sampling is needed to better determine the distribution and abundance of salmonids throughout this area.

Fish Habitat Relationship

The subbasin supports populations of chinook and coho salmon, and steelhead. In 2001, the DFG coho project snorkel surveys found coho salmon in three subbasin tributaries. Most tributaries support strong, multi-year class juvenile steelhead rearing populations based upon recent DFG stream surveys. A few tributaries have favorable summer water temperatures for summer rearing of juvenile salmon.

Fish Passage Barriers

One stream crossings was surveyed in the Eastern Subbasin as a part of the Humboldt County culvert inventory and fish passage evaluation conducted by Ross Taylor and Associates (2000). Shelter Cove Road has a culvert on Painter Creek. This culvert was found to be a partial and temporary salmonid barrier (Table 18.). Priority ranking of 67 culverts in Humboldt County for treatment to provide unimpeded salmonid passage to spawning and rearing habitat placed the culvert on Shelter Cove Road at rank 10. Criteria for priority ranking included salmonid species diversity, extent of barrier present, culvert risk of failure, current culvert condition, salmonid habitat quantity, salmonid habitat quality, and a total salmonid habitat score. No improvement of the culvert on Painter Creek is currently proposed (G. Flosi, personal communication).

Table 18 Culverts surveyed for barrier status in the Eastern Subbasin (Taylor, 2000; G. Flosi, personal communication).

Stream Name	Road Name	Priority Rank	Barrier Status	Upstream Habitat	Treatment
Painter Creek	Shelter Cove Road	10	Temporary and partial barrier. The culvert is a partial and temporary barrier for adults and a total barrier to juveniles. An excessive jump (3-5 ft) is required to enter the culvert. The concrete divider reduces the "target" size of the outflow that fish must jump into for entry.	1.1 miles of good to fair salmonid habitat.	None proposed at this time

Salmomid Habitat Charts

The Department of Fish and Game conducted salmonid habitat surveys in 51 tributary streams of the Mattole watershed in the period 1991-1999 following methods described by the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1991, 1998). Of the several stream attributes collected, those used in the NCWAP Ecological Management Decision Support system model in assessing stream reach conditions of salmonid habitat are canopy cover, embeddedness, percent pools, pool depth, and pool shelter. These habitat attributes are presented in the Analysis and Results by Subbasin section of this report as graphical bar charts. The bar charts were prepared in KRIS Mattole and present summary data for each surveyed stream. All the habitat attributes presented in bar charts are interpreted using the response curves operating in the EMDS Stream Reach Model. The EMDS values used for assigning these ratings are given in Table EMDS 4, in this report's Program and Introduction Section.

These graphics present the same data used in the EMDS Stream Reach Model, but summarize those data for an entire stream where more than one reach was surveyed. Of the Mattole streams surveyed, 12 had two reaches surveyed, three had three reaches surveyed, two had four reaches surveyed, and one had five reaches surveyed. Four streams where surveys covered less than 1000' feet were not included in the bar charts due to concerns about low sample size.

Five charts are presented in the same order and format in four Subbasin Results sections of this report. **Chart 1** (e.g. Figure NH1, Figure WH1) presents the relative percent conifer canopy, deciduous canopy, and open canopy (no canopy) above surveyed streams. Canopy cover, and the relative cover by coniferous versus deciduous trees were measured at each habitat unit during DFG stream surveys. Chart 1 presents averages weighted by unit length to give the most accurate representation of the percent of a stream under these types of canopy. As described in the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% is considered fully suitable, and total canopy less than 50% is fully unsuitable for contributing to cool water temperatures that support salmonids.

Chart 1 is useful for interpreting the condition of riparian canopy with respect to vegetation type. The near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature in contact with the stream, which is an important factor in determining stream water temperature. The EMDS watershed scale model considers the status of the nearstream forest component. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter.

Larger streams generally have more open canopy and deeper pools than small streams. This is partially a function of wider stream channels and greater stream energy due to higher discharge during storms. The charts in this section of the report list streams on the vertical axis in descending order by drainage area (largest at the top) in order to allow some resolution on this size factor. By such a presentation, one would expect a trend in canopy cover and pool depth values. Deviations from the expected trend in canopy or pool depth may indicate streams with more suitable or unsuitable canopy or pool depth conditions relative to other streams of that subbasin.

Chart 2 (e.g. Figure NH2) presents cobble embeddedness categories as measured at every pool tail crest. The EMDS Reach Model considers cobble embeddedness greater than 50% to be somewhat unsuitable and 100% to be fully unsuitable for the survival of salmonid eggs and embryos. Chart 2 is useful for examining the distribution of embeddedness values encountered in a stream, and among steams within the subbasin.

Habitat categories by percent survey length are described in **Chart 3** (e.g. Figure NH3) showing the abundance of overall pool, flatwater, and riffle habitats, as well as the percent of a surveyed stream reach that is de-watered, if any, at the time of the survey. During their life history, salmonids require access to all of these types of habitat. EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable.

Chart 4 (e.g. Figure NH4), illustrates the percent length of a survey composed of deeper, high quality pools. The amount of pool habitat of sufficient depth to be fully suitable for anadromous salmonids is considered in the EMDS Reach Model as the percent of primary pools determined by a range of pool depths, depending on the order (size) of the stream. Generally, a reach must have 30 – 55% of its length in these high quality pools for its stream class to be in the suitable ranges (EMDS Table 4).

Chart 5 (e.g. Figure NH5) shows pool shelter rating, which illustrates relative pool complexity, another component of pool quality. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of thirty. The range from 100 to 300 is fully suitable.

The surveyed streams of the eastern Mattole show a wide range of percent canopy levels (49%-99% total canopy) that vary in their EMDS rating from completely unsuitable to completely suitable (Figure EH1). Existing canopy is strongly dominated by deciduous trees in this subbasin. Embeddedness values in the Western Subbasin are somewhat unsuitable or worse for the survival of developing salmonid eggs and embryos (Figure EH2). Most surveyed southern tributaries have less than 20% pool habitat by length indicating unsuitable conditions for salmonid rearing and holding (Figure EH3). Eubank Creek has the most pool habitat (33%) and the highest frequency of deeper pools (Figure EH4), but other streams are unsuitable with respect to pool depth. Pool shelter ratings in eastern tributaries are among the lowest in the Mattole watershed and offer unsuitable pool habitat complexity and cover for anadromous fish (Figure EH5).

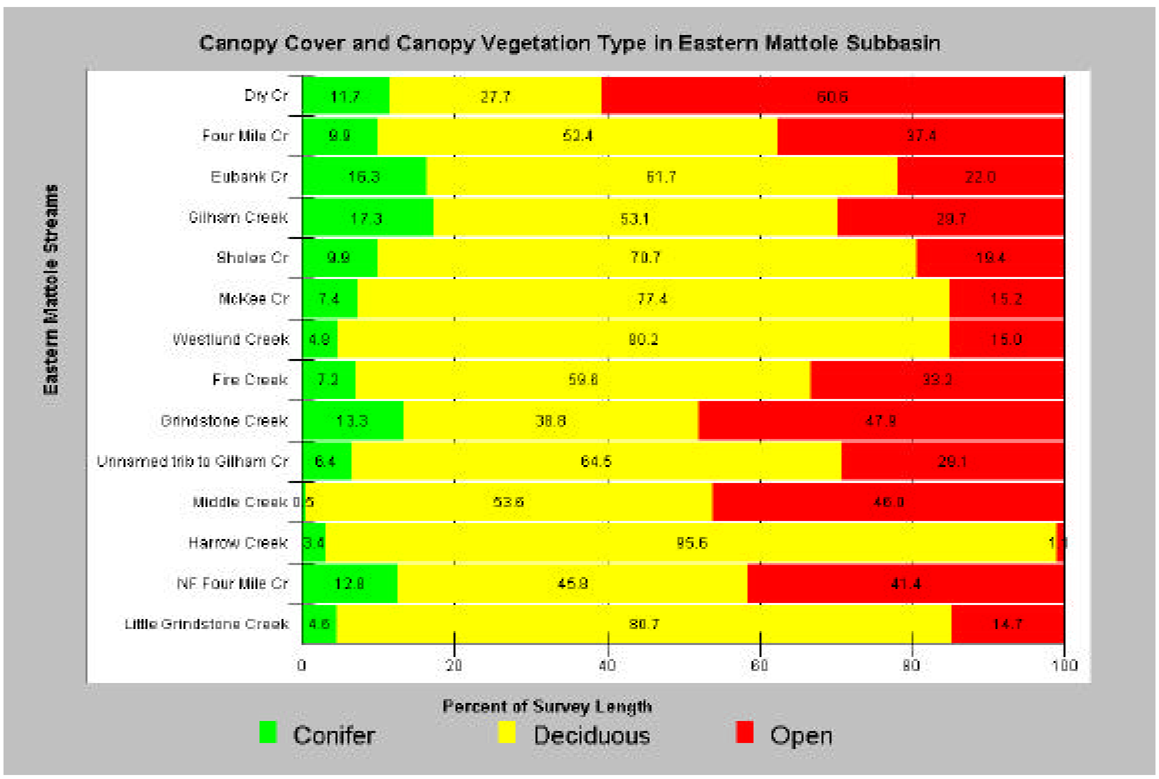

Figure EH1: Canopy cover and canopy vegetation types from DFG stream surveys of the Eastern Mattole Subbasin. Chart from KRIS Mattole.

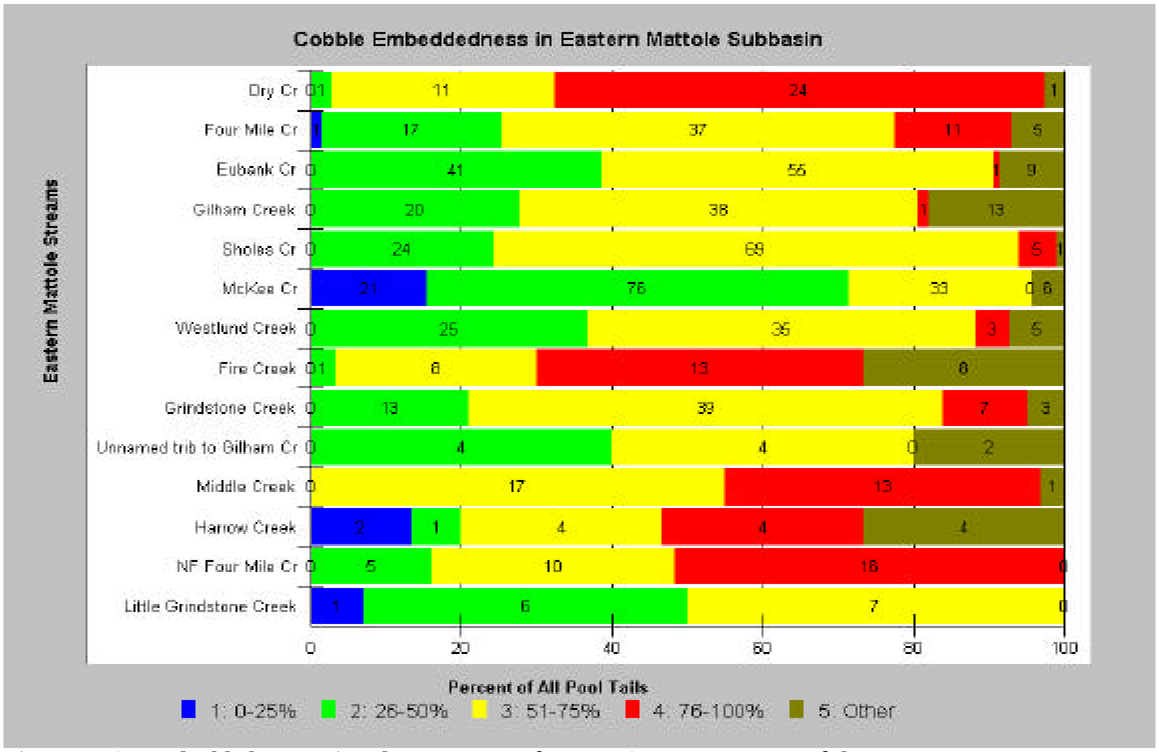

Figure EH2: Embeddedness ratings by occurrence from DFG stream surveys of the Eastern Mattole Subbasin. Substrate embeddedness categories in excess of 50% are considered by EMDS to be somewhat unsuitable to fully unsuitable for the survival of salmonid eggs and embryos. Chart includes those pool tails deemed unsuitable for spawning due factors other than embeddedness (e.g., a log sill, etc., Category Five). Chart from KRIS Mattole.

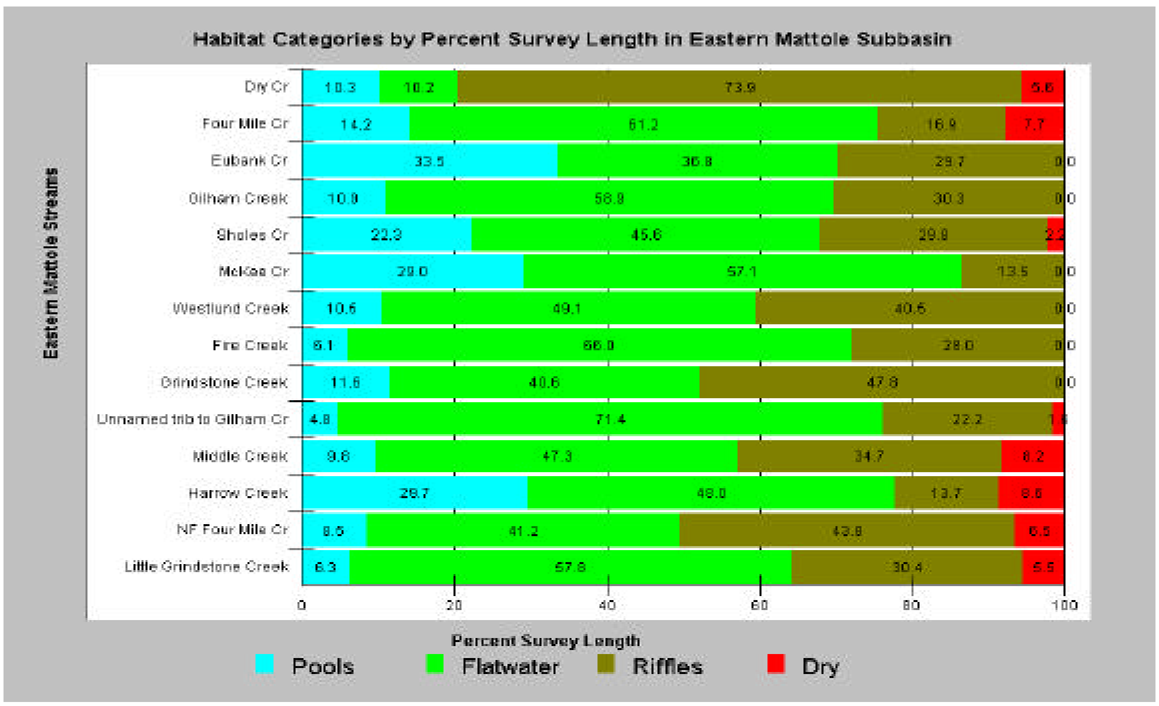

Figure EH3: Habitat types by percent survey length from DFG stream surveys of the Eastern Mattole Subbasin. Chart from KRIS Mattole.

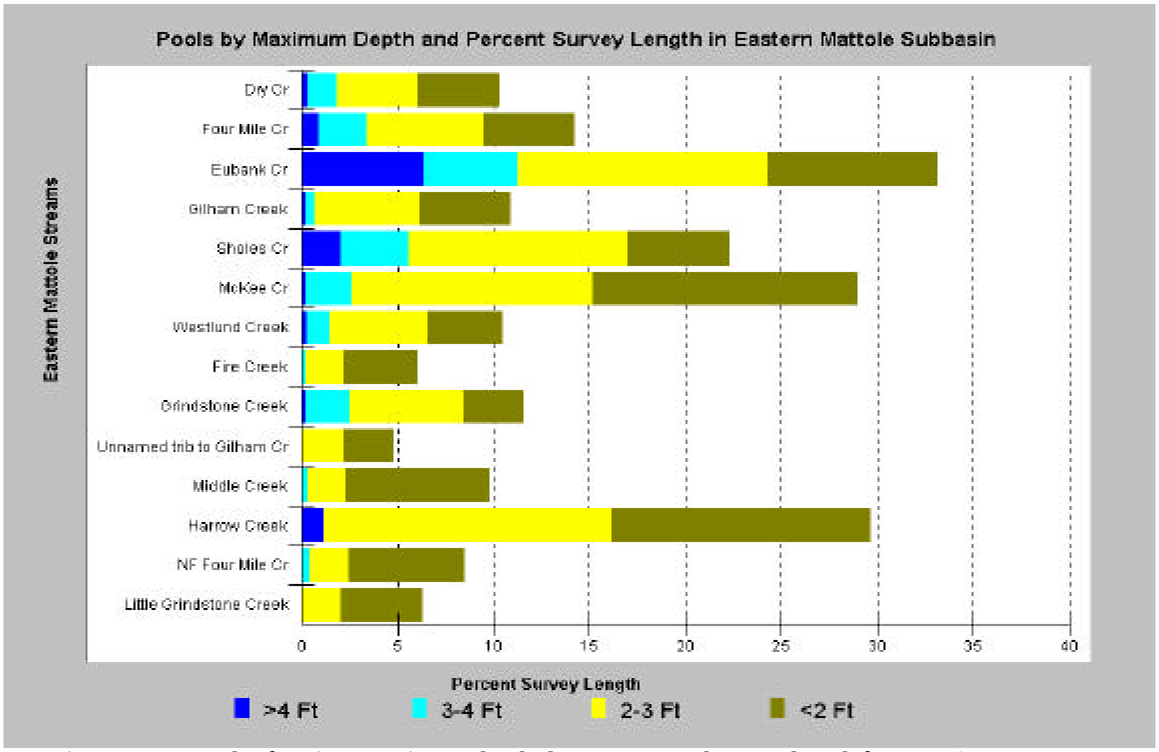

Figure EH4: Pools of various maximum depths by percent total survey length from DFG stream surveys of the Eastern Mattole Subbasin. Portrayed values sum to the length of percent pool habitat in Figure EH3. Chart from KRIS Mattole.

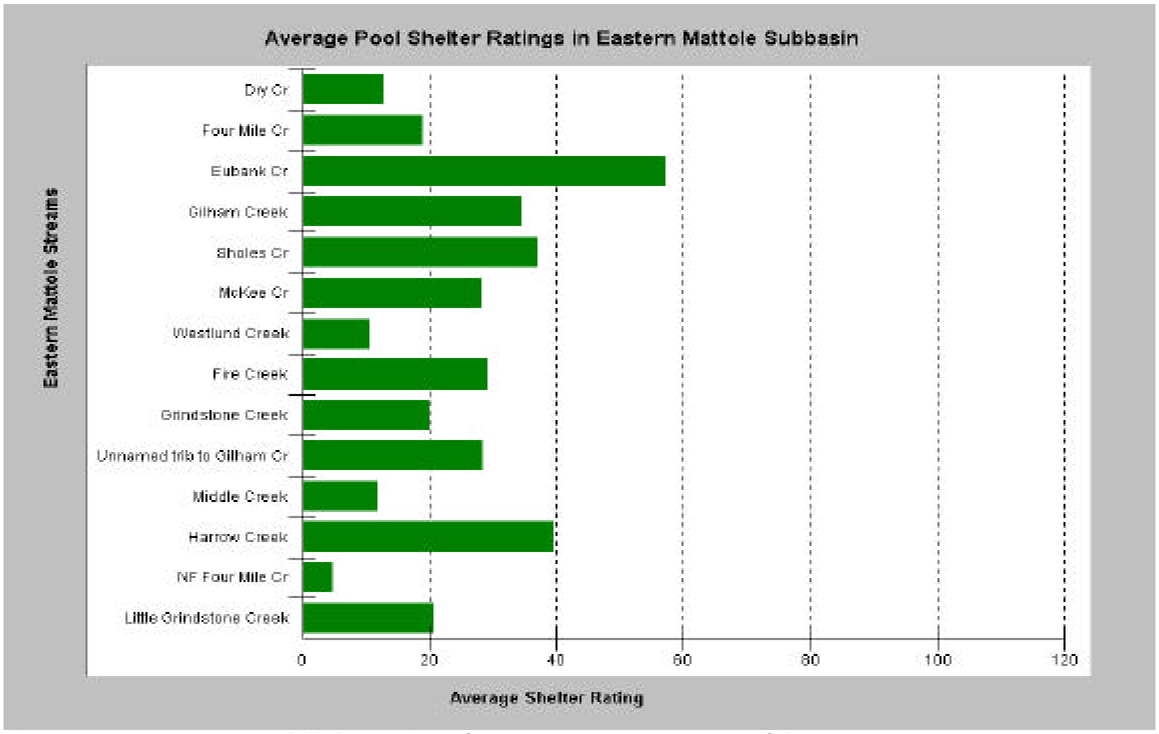

Figure EH5: Average pool shelter ratings from DFG stream surveys of the Eastern Mattole Subbasin. An EMDS rating in the range 100-300 is considered fully suitable (X-axis is truncated here). Chart from KRIS Mattole.

Subbasin Trends

The trends for several factors within the Mattole River tributaries in the Eastern subbasin can be summarized as follows. The size and density of the riparian zone woody vegetation in privately owned timberlands will increase over time due to timber harvesting plan regulations. Those timberlands owned by the public are withdrawn from management activities and the size and density of the riparian zone woody vegetation is also expected to increase over time. There is no trend that can be inferred for riparian areas that are grazed by livestock. Humboldt County requires new construction set-backs from watercourses that will help preserve existing riparian vegetation, but the clearing of vegetation by landowners as part of rural residential living is not regulated outside of the Coastal Zone. Trends for riparian zones bordered by or containing roads are also unclear. It is possible that some roads may be abandoned and riparian vegetation re-established, but many of the roads are County roads, lead to streamside County Roads or access rural residential parcels. Riparian vegetation may be sacrificed in road maintenance activities, both regular and storm induced.

The number of roads within the watershed can be expected to increase as timberlands are harvested for the first time since the application of Forest Practice rules. These rules and current practices generally require road systems located high on the slope unlike earlier timber harvest and transportation systems that established roads low on the slopes, often near streams. Lands recently purchased for the Gilham Butte reserve that will be in Bureau of Land Management (BLM) ownership and management when transactions are complete will have road assessment and inventory evaluation as part of a change in landowner objectives.

The short time period of stream temperature data results does not allow for any trend analysis. There is no data on suspended sediment.

Disturbed stream channel percent appears to have decreased during the time period of 1984 to 2000. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one hundred year return events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Subbasin Issues

- Land use practices on steep and/or unstable slopes should be in accordance with guidelines and recommendations in DMG Note 50.
- Roads – There is concern over abandoned roads and new road construction, and road maintenance issues related to land-sliding and sediment input. Without appropriate maintenance or storm-proofing, existing roads, both active and abandoned, may continue to supply sediment. Road inventories have been completed for a small portion of this planning basin, and it is recommended that this effort be continued until a complete inventory is compiled.
- This planning basin is heavily sub-divided so that there is high impact on the land from road density, human habitation, land disturbance from building of structures, and land modification, including diversion of surface waters.

- Water chemistry – No data is available on pH, DO, nutrients.

- A diesel spill in Blue Slide Creek, reported in April 2000 to the North Coast Regional Water Quality Control Board, is currently undergoing remediation and monitoring by the Board.

- Water temperatures – Available data suggests that summer high temperatures exceed optimal conditions throughout much of this planning basin in the lower depositional reaches of most tributaries. Mattole Canyon Creek has elevated temperatures in most of its reaches.

- Instream sediment sampling is inadequate to conduct analyses.

- Canopy shade data is insufficient at this time to conduct analyses.

- Large woody debris recruitment potential is generally adequate for the majority of this planning basin with the exception of the highland grassland areas along the eastern margins.

- Limited access to public lands minimizes opportunities for public recreation.

- Wildlife/Plants -- Inadequate information exists to assess the status and trends of flora and fauna, including invasive species. Local landowners report that coyotes are prevalent and uncontrolled.

- Aquatic macro-invertebrate productivity – No data is available in this planning basin to quantify potential foods sources available to fish.

- In-stream habitat diversity and complexity – Based on available data, instream habitat appears to be insufficiently diverse. In many streams inadequate pool depth and a lack of cover and large woody debris have contributed to a simplification of instream fish habitat.

- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

Subbasin Issue Synthesis

Working Hypothesis 1: ***Summer stream temperatures in many subbasin tributaries are not within the range of temperatures that fully support healthy anadromous salmonid populations.***

Supportive Findings:

- All MWATs for Westland Creek, Mattole Canyon Creek, Blue Slide Creek, and Eubanks Creek were above the 50-60ºF range for optimal coho growth for 1996-2001 except Eubanks Creek in 2001.

- Low canopy levels appear to be a function of both riparian cover depletion from land use and stream widening due to high sediment inputs, especially in 1964.

Working Hypothesis 2: *Tributary conditions in the Eastern subbasin are the most variable in the Mattole Basin.*

Supportive Findings:

- The DFG Coho Assessment Project found coho salmon in three subbasin tributaries with good habitat and favorable water temperatures in 2001.
- However, four tributaries had water temperatures that were not fully supportive of salmonids.

Recommendations:

1. Ensure that near stream areas are managed to reduce solar radiation and moderate air temperatures in order to reduce heat inputs to the Mattole River and its tributaries.
2. Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.
3. Monitor 24 hour summer water and air temperatures to detect trends using continuous monitoring thermographs.
4. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.
5. Based upon the latest science on placement of large woody debris in stream channels managers in the Western subbasin should work to improve channel structure and function for salmonids.
6. Continue efforts such as road improvements and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.

Southern Mattole Subbasin

Introduction

The Southern subbasin is located south of Bridge Creek (River Mile 52.1) and McKee Creek (River Mile 52.8), both near Thorn Junction, and continues upstream to the Mattole's headwaters near Four Corners (River Mile 61.5), a distance along the Mattole mainstem of about 9.4 river miles (see map on following page). There are twenty-seven perennial streams that drain a watershed area of 28 square miles. The DFG has recently surveyed 21.9 miles of the subbasin's anadromous reaches. Elevations range from 930' at Bridge Creek to approximately 1,500' in the headwaters of the tributaries.

Climate

The Southern subbasin temperature and precipitation totals are influenced by the King Range immediately west of the area. Temperatures reflect the inland location ranging from sub-freezing to above 100° F but generally stay between 55° and 85° F. Rainfall totals average between 70 and 85 inches.

Hydrology

The Southern subbasin is made up of two complete Calwater Units (Map on following page). There are 23.5 perennial stream miles in 27 perennial tributaries in this subbasin (Table 15). Twelve of these tributaries have been inventoried by the DFG. There were 16 reaches, totaling 19.5 miles in the inventory surveys. The inventories included channel and habitat typing, and biological sampling.

In their inventory surveys, the DFG crews utilize a channel classification system developed by David Rosgen (1994) and described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

In the Southern subbasin, there were three type B channels, totaling 3.2 miles; three type E channels, totaling 3.3 miles; eight type F channels, totaling 7.4 miles; and one type G channel, totaling 0.1 miles. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders. Type E stream reaches are narrow, deep, single thread channels. They are slightly entrenched, low gradient reaches with consistent riffle/pool sequences. Type E reaches flow through wide alluvial valleys and have frequent meanders. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders. Type G or gully stream reaches are similar to F types but are narrow and deep. With few exceptions, type G reach types possess high rates of bank erosion as they try to widen into a type F channel. Type G reach types are found in a variety of landforms, including meadows, developed areas, and newly established channels within relic channels (Flosi, et al., 1998).

Geology

The geologic conditions in the Southern subbasin are the most uniform and stable in the Mattole basin. The subbasin is underlain by Franciscan Coastal terrane rocks that are generally less broken and, therefore, more resistant to erosion and slope instability in comparison to bedrock in the other subbasins. Overall relief is the lowest of the subbasins; however, the relatively stable condition of the bedrock has led to the formation of sharp-crested topography dissected by more straight, well-incised sidehill drainages with steep, heavily forested slopes. In the lower reaches of the larger tributaries and along the main stream of the Mattole, the active streams become confined to a narrow channels incised below broader valley bottoms formed by bedrock strath terraces with a thin mantle of alluvium. Drainage orientations generally follow, or are perpendicular to, the dominant northwest-trending structural fabric of the bedrock in the area. The more intact condition of the bedrock is reflected in the presence of comparatively few deep-seated landslides in the Southern subbasin. The larger dormant landslides that have been detected from aerial photographs are widely scattered throughout the subbasin Most of the active mass wasting activity appears to be in the form of debris slides, and the majority of these are observed adjacent to streams, or in association with roads.

Insert Southern Subbasin Map Here.

Table 19 Surveyed Streams with Estimated Anadromy in the Southern Subbasin

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
Bridge Creek	Y		2.8		
	Y	3.1			
	Y	0.7		1	F4
	Y	0.5		2	
	Y	1.9		3	F4
Robinson Creek	N		1.5		
West Branch Robinson Creek	N		1.0		
Vanauken Creek	Y		1.1		
	Y	1.4		1	F4
	Y	0.1		2	G4
South Fork Vanauken Creek	Y	0.1			
Anderson Creek	Y	0.9	0.1	1	B3
Ravasoni Creek	N		0.0		
Upper Mill Creek	Y	0.2	2.3	1	F4
Harris Creek	N		0.8		
Gibson Creek	N		1.0		
Upper Mattole River	N		7.0	1	F3
Stanley Creek	Y	1.0	1.0	1	F4
Baker Creek	Y	2.2	1.7	1	F4
Thompson Creek	Y		3.2		
	Y	1.6		1	B1
	Y	1.7		2	F1
Yew Creek	Y	0.7	1.3	1	B4
Helen Barnum Creek	Y	0.9	0.6	1	E4
Lost Man Creek	Y	1.2	0.5	1	E4
Unnamed Tributary to Lost Man Creek	Y	1.2		1	E4
Big Alder Creek	N				
Pipe Creek	N				
Dream Stream	N				
Arcanum Creek	N				
Big Jackson Creek	N				
Phillips Creek	N		0.1		

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
McNasty Creek	N		1.0		
Ancestor Creek	N		0.3		

Vegetation

Section under development.

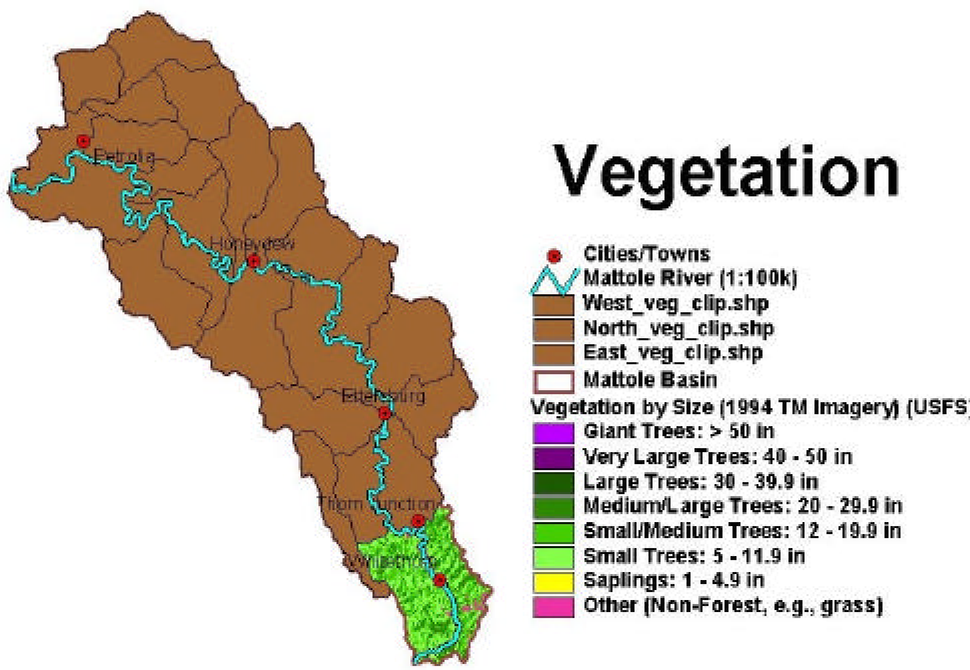

Figure 28: Vegetation of the Southern Subbasin.

Land Use

The watershed is largely subdivided into small parcels and is the most densely populated planning basin of the Mattole (Figure 29). The town of Whitethorn is located at the middle of this subbasin near the confluence of Upper Mill Creek and the Mattole River. The human population has contributed to reduced summer flows in some of the tributaries and the mainstem itself above Baker Creek due to domestic and agricultural water consumption. About half of the watershed is managed for timber production (Figures 30 and 31, Table 13) and is unique to the Mattole as a redwood production zone. Controversy over timber harvest issues have occurred in the past, focused on stands near what is now the 4,700 acre Sanctuary Forest, but today much of the land in contention has been sold or traded into public ownership as ecological reserves. There is interest from some local citizens to expand the size of the reserves.

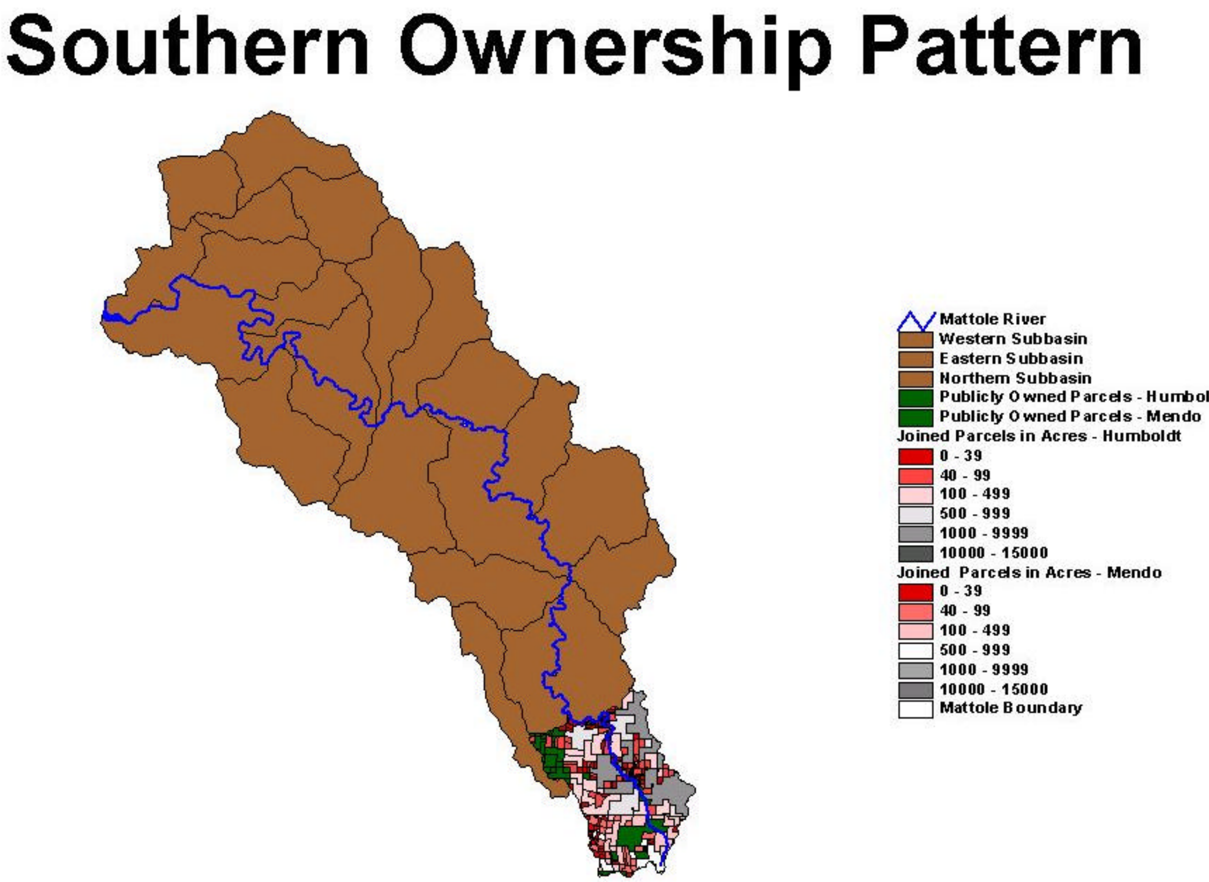

Figure 29: Ownership Patterm of the Southern Subbasin.

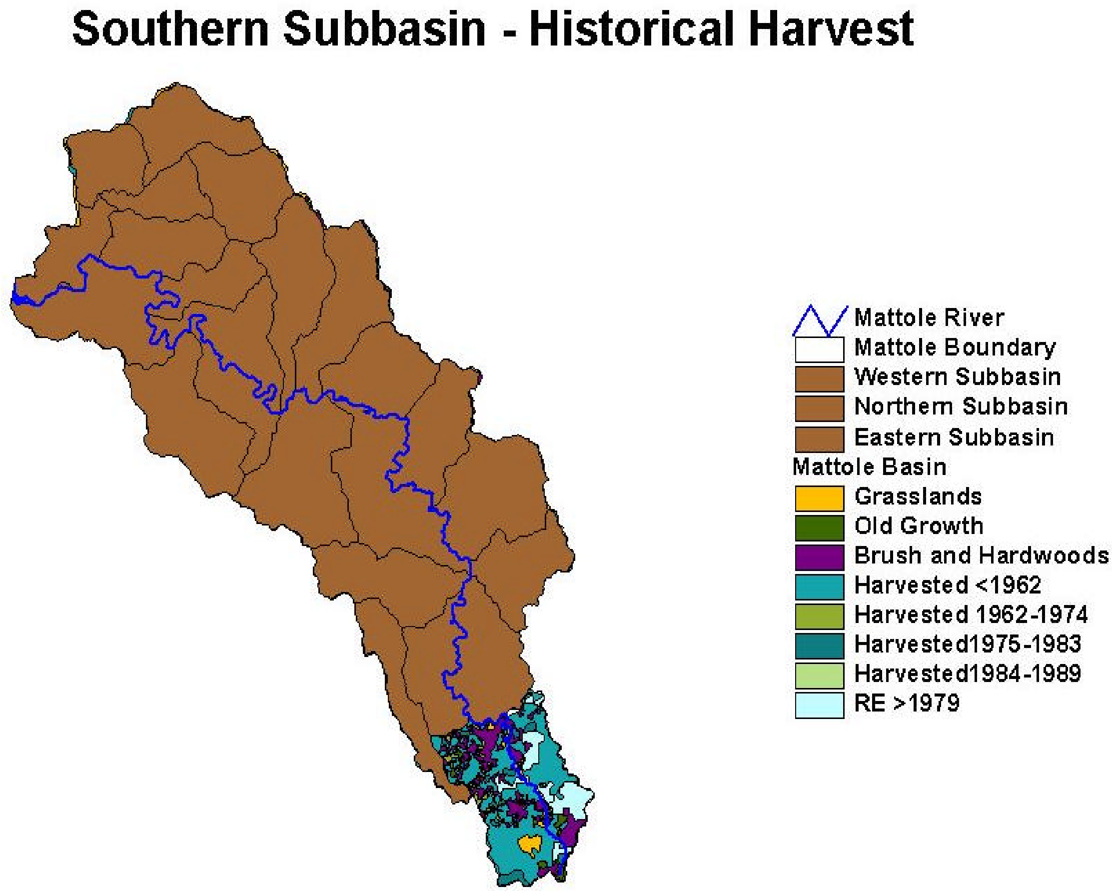

Figure 30: Timber Harvest History of the Southern Subbasin.

Table 20: Timber Harvest History, Southern Mattole Subbasin.

TIMBER HARVEST HISTORY - SOUTHERN MATTOLE SUBBASIN		
	Total Acres	Percent of Area
Harvested 1945-1961	8,875	50%
Harvested 1962-1974	546	3
Harvested 1975-1983	1,053	6
Harvested 1984-1989	1,519	9
Harvested 1990-1999	1,945	11
Harvested 2000-2001 (partial)	240	1

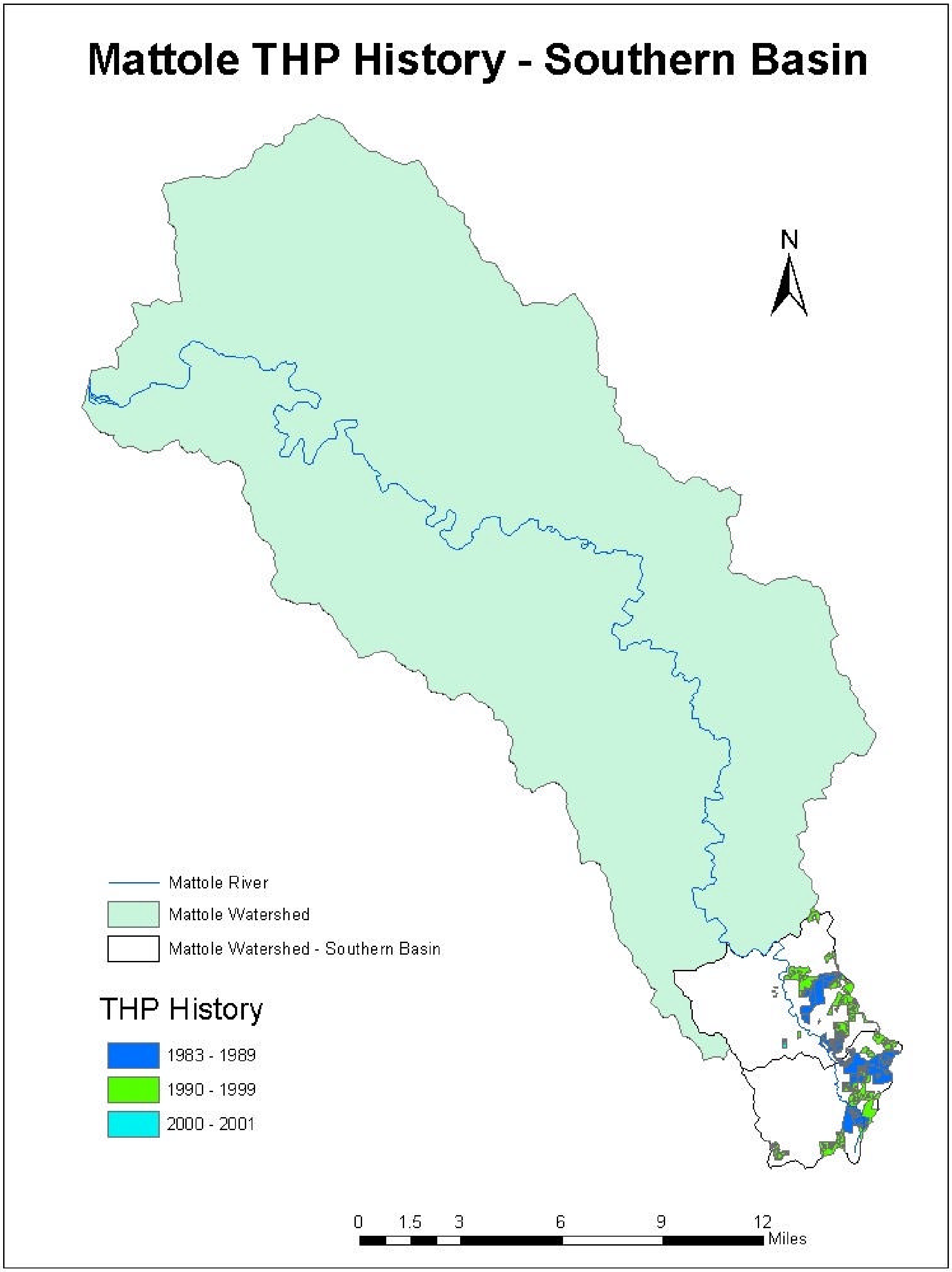

Figure 31: Timber Harvest Plans (THPs) of the Southern Subbasin.

Fluvial Geomorphology

The fluvial geomorphology of the Southern subbasin is characterized by the lowest percentage of disturbed channel and stream bank erosion. These general observations come from a quick review of the 1984 and 2000 aerial photographs, which will be incorporated in

Table 3 (table still under development). The Southern subbasin includes streams within the Bridge Creek, and Thompson Creek planning watersheds.

Although the Southern subbasin is the most stable geologic area in the basin, it contains an extensive and largely un-surfaced road system to service the rural sub-divisions located there. Most roads are used year round by residents, exacerbating the already high production rates of fine sediment into the stream network. This condition is deleterious to stream habitat for salmonids. These impacts, especially in the depositional, lower reaches of the tributaries and the mainstem, adversely affect spawning conditions for adult salmonids, and reduce pool volume for optimal juvenile rearing. Summer low flow reductions, impacted by human water extraction, also adversely affect juvenile rearing. Considering the generally ideal water temperatures in the area, flow reduction becomes a serious problem for the overall salmonid fishery of the Mattole.

Aquatic/Riparian Conditions

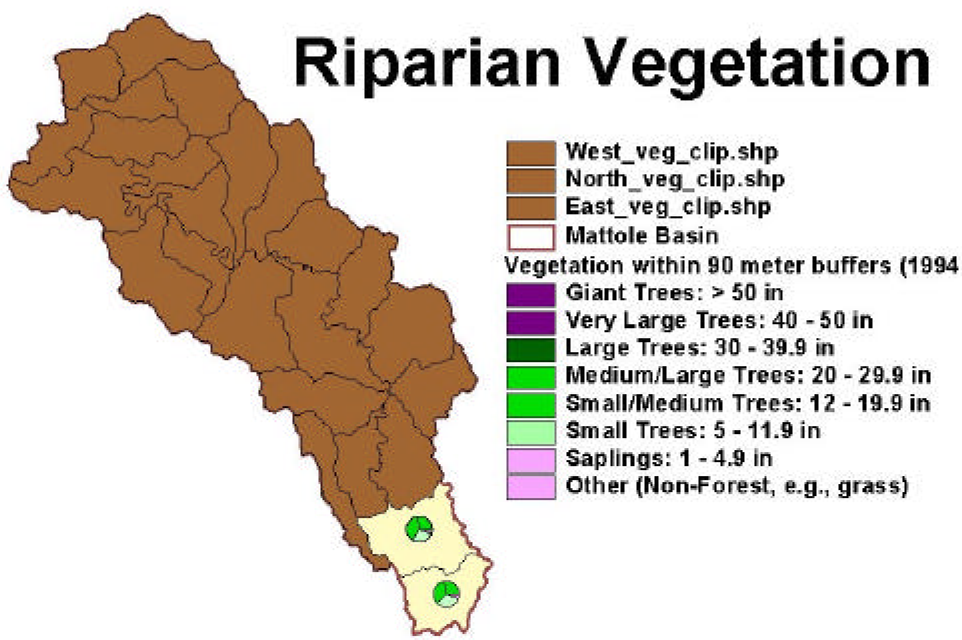

Figure 32: Riparian Vegetation of the Southern Subbasin.

Since the subbasin consists of only two planning watersheds, the tables illustrating the similarities between the vegetation in the entire planning watersheds and the 90 meter wide riparian width are representative of the entire subbasin (Figures 32-36).

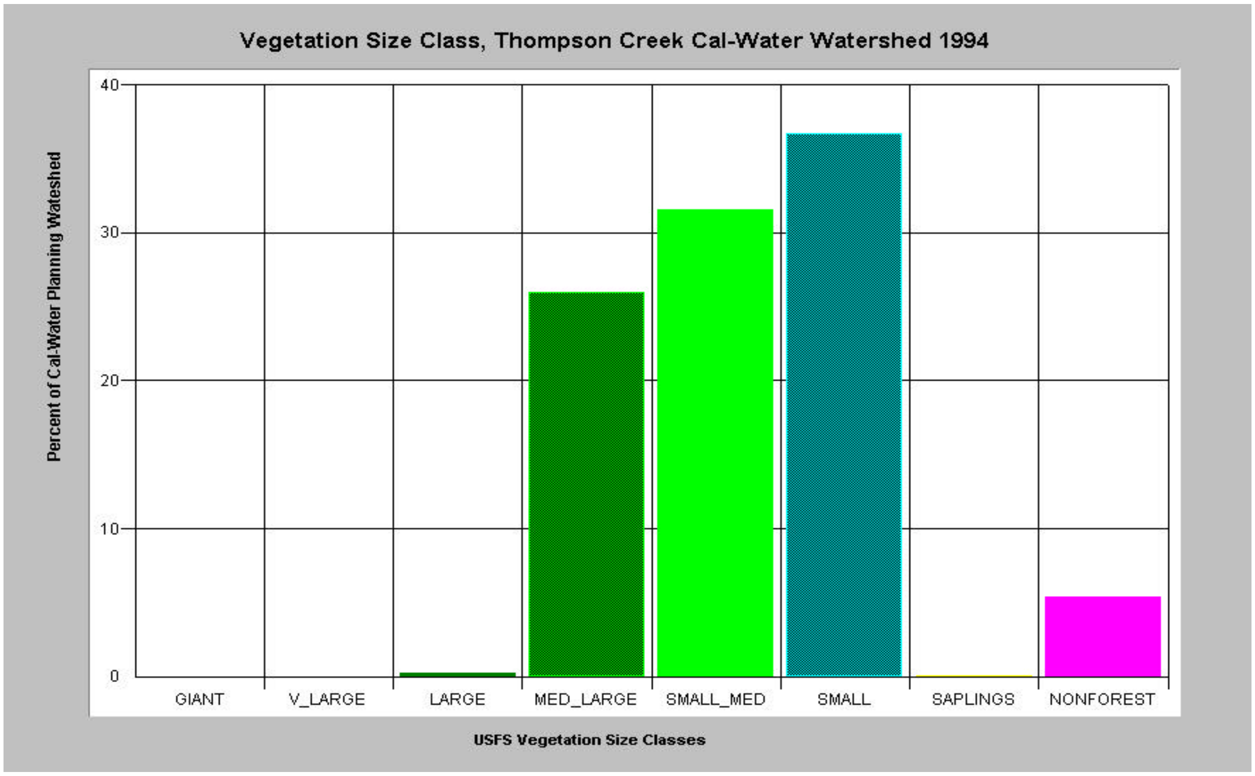

Figure 33: Vegetation Size Class, Thompson Creek Planning Watershed 1994.

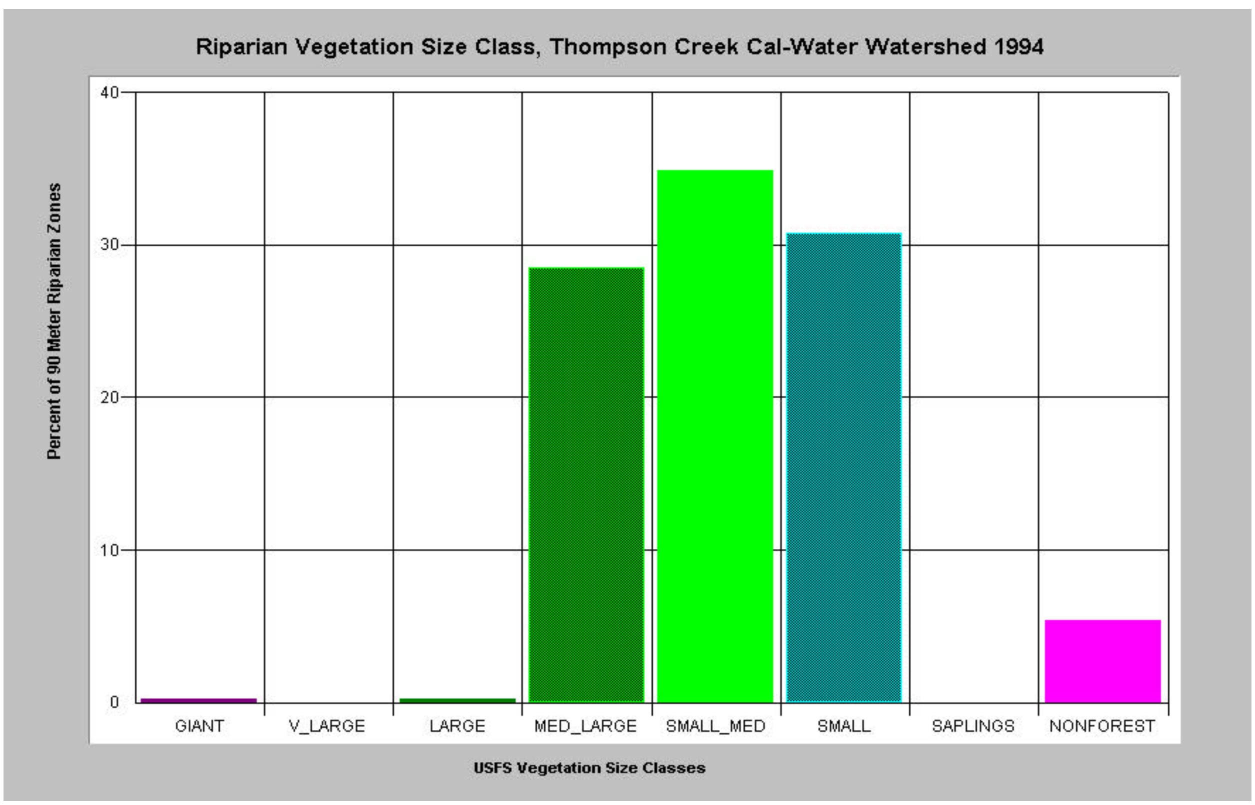

Figure 34: Riparian Vegetation Size Class, Thompson Creek Planning Watershed 1994.

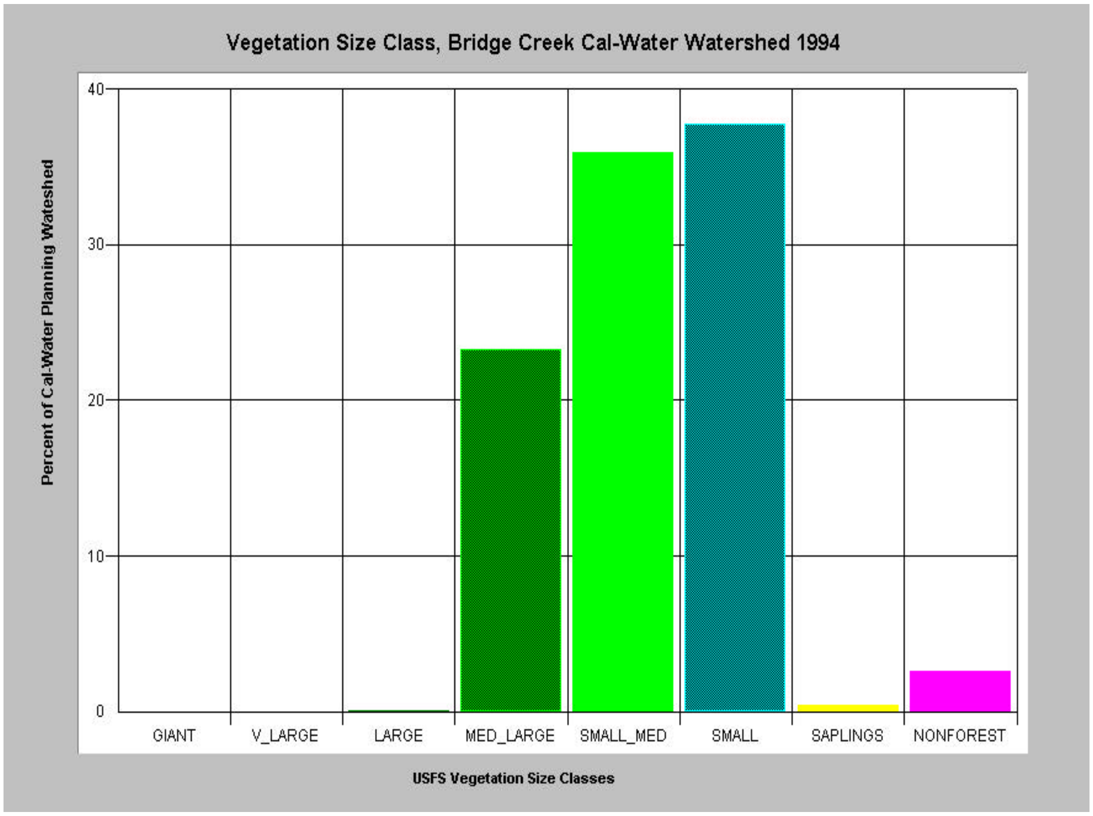

Figure 35: Vegetation Size Class, Bridge Creek Planning Watershed 1994.

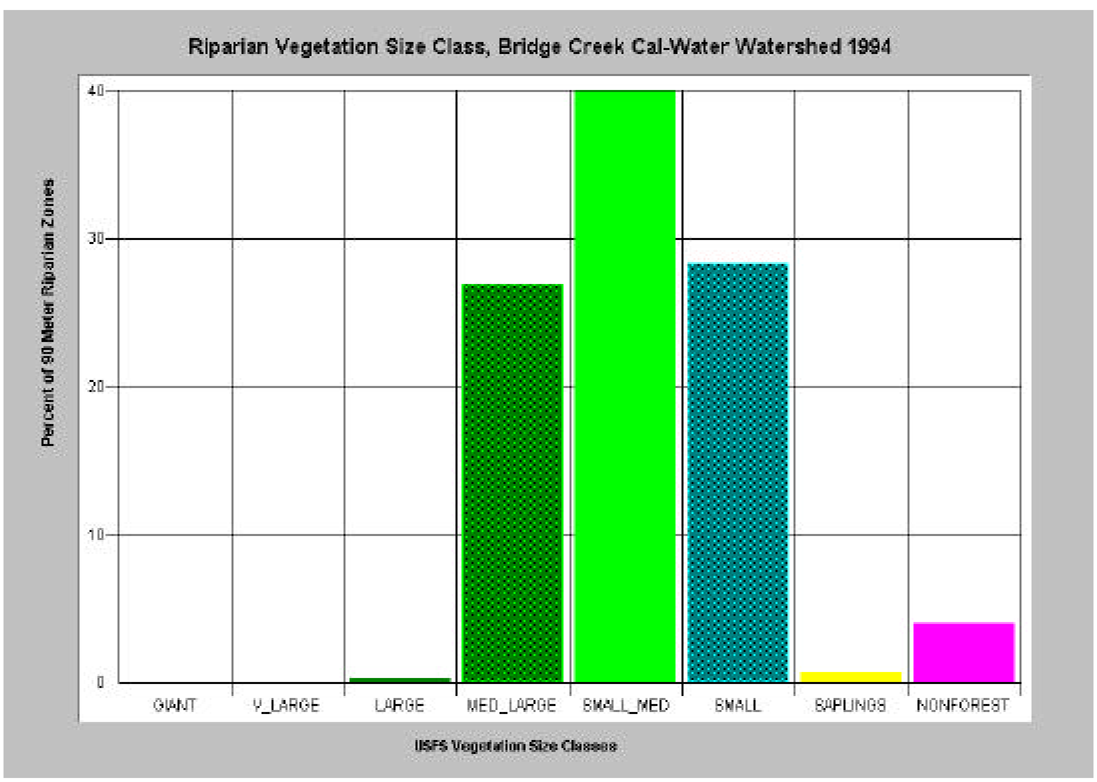

Figure 36: Riparian Vegetation Size Class, Bridge Creek Planning Watershed 1994.

Fish History and Status

This subbasin has the highest fish productivity in the Mattole Basin.

Fish Habitat Relationship

The subbasin supports populations of chinook and coho salmon, and steelhead. In 2001, the DFG coho project snorkel surveys found coho salmon in one subbasin tributary. In recent years, the DFG Restoration Program has found coho in five other tributaries and the mainstem. Most tributaries support strong, multi-year class juvenile steelhead rearing populations based upon recent DFG stream surveys. Nearly all tributaries have favorable summer water temperatures for summer rearing habitat. This is one of the most important spawning reaches for all salmonids in the Mattole system. The Mattole Salmon Group has operated cooperative hatcheries with the DFG since 1981 in the Mattole, and much of that effort has been located in this area. The Mattole Salmon Group traps native chinook and coho, and has released over 400,000 fingerlings and yearlings during the period of operation.

Fish Passage Barriers

Six stream crossings were surveyed in the Southern Subbasin as a part of the Humboldt and Mendocino County culvert inventories and fish passage evaluations conducted by Ross Taylor and Associates (2000, 2001). Briceland Road has a culvert on Ancestor Creek, and Whitethorn Road has culverts on Baker Creek, Gibson Creek, Harris Creek, Ravasoni Creek (East Anderson Creek), and Stanley Creek. The culvert on Ancestor Creek was found to be a total salmonid barrier and the culverts on Gibson Creek, Harris Creek and Stanley Creek were found to be partial salmonid barriers (Table 21.). The culvert on Ravasoni Creek (East Anderson Creek) was found to be a temporary and partial salmonid barrier while the culvert on Baker Creek was not found to be a salmonid barrier. In fact, the culvert in Baker Creek was thought to be the best road crossing observed in Humboldt County in the course of the inventory. Priority ranking of 26 culverts in Mendocino County for treatment to provide unimpeded salmonid passage to spawning and rearing habitat placed the culvert on Ancestor Creek at rank 3. In a similar list of priority rankings for 67 culverts in Humboldt County, rankings of culverts in the Southern Subbasin ranged from 15 for Stanley Creek to 43 for Baker Creek. Criteria for priority ranking included salmonid species diversity, extent of barrier present, culvert risk of failure, current culvert condition, salmonid habitat quantity, salmonid habitat quality, and a total salmonid habitat score. The culvert on Ravasoni Creek (East Anderson Creek) is scheduled for improvements in 2002 while the culverts on Gibson Creek and Stanley Creek were proposed but not funded at this time for improvement (G. Flosi, personal communication).

Table 21 Culverts surveyed for barrier status in the Southern Subbasin (Taylor, 2000; G. Flosi, personal communication).

Stream Name	Road Name	Priority Rank	Barrier Status	Upstream Habitat	Treatment
Ancestor Creek	Briceland Road	3	Total barrier. A barrier for adult coho and steelhead and all age classes of juveniles.	2.0 miles of good salmonid habitat.	None proposed at this time
Baker Creek	Whitethorn Road	43	Not a barrier. Short of a bridge this was the BEST crossing observed in Humboldt County.	Approximately 1.6 miles of good salmonid habitat.	None proposed at this time
Gibson Creek	Whitethorn Road	19	Partial barrier. The culvert is nearly a complete barrier for adults and a complete barrier to juveniles. An excessive jump (4.9 ft at low flow) is required to enter culvert. Velocities are also excessive due to steep slope and length of pipe.	1.0 to 1.7 miles of potential salmonid habitat.	Proposed but not funded for improvement
Harris Creek	Whitethorn Road	40	Partial barrier. The culvert is not a barrier for adults and a partial barrier to juveniles. For juveniles, an excessive jump is required to enter the culvert.	0.75 to 1.75 miles of potential salmonid habitat.	None proposed at this time
Ravasoni Creek (East Anderson Creek)	Whitethorn Road	20	Temporary and partial barrier. The culvert is a temporary barrier for adults (20-40% passable for coho and 60-80% passable for steelhead) and a total barrier to juveniles. An excessive jump is required to enter the culvert, even for adults. Excessive velocity is caused by steep slope (at inlet, steeper slope along first 20 ft).	1.1 miles of potential salmonid habitat.	Funded and scheduled for improvement in 2002
Stanley Creek	Whitethorn Road	15	Partial barrier. The culvert is probably not a barrier for adults, but a complete barrier to juveniles. For juveniles, an excessive jump is required to enter culvert. Leakage through rusted bottom may be harmful to out-migrating juveniles. Steelhead observed above the culvert, however, coho were only seen below the culvert.	Approximately 1.7 miles of potential salmonid habitat.	Proposed but not funded for improvement

Salmonid Habitat Charts

The Department of Fish and Game conducted salmonid habitat surveys in 51 tributary streams of the Mattole watershed in the period 1991-1999 following methods described by the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1991, 1998). Of the several stream attributes collected, those used in the NCWAP Ecological Management Decision Support system model in assessing stream reach conditions of salmonid habitat are canopy cover, embeddedness, percent pools, pool depth, and pool shelter. These habitat attributes are presented in the Analysis and Results by Subbasin section of this report as graphical bar charts. The bar charts were prepared in KRIS Mattole and present summary data for each surveyed stream. All the habitat attributes presented in bar charts are interpreted using the response curves operating in the EMDS Stream Reach Model. The EMDS values used for assigning these ratings are given in Table EMDS 4, in this report's Program and Introduction Section.

These graphics present the same data used in the EMDS Stream Reach Model, but summarize those data for an entire stream where more than one reach was surveyed. Of the Mattole streams surveyed, 12 had two reaches surveyed, three had three reaches surveyed, two had four reaches surveyed, and one had five reaches surveyed. Four streams where surveys covered less than 1000' feet were not included in the bar charts due to concerns about low sample size.

Five charts are presented in the same order and format in four Subbasin Results sections of this report. **Chart 1** (e.g. Figure NH1, Figure WH1) presents the relative percent conifer canopy, deciduous canopy, and open canopy (no canopy) above surveyed streams. Canopy cover, and the relative cover by coniferous versus deciduous trees were measured at each habitat unit during DFG stream surveys. Chart 1 presents averages weighted by unit length to give the most accurate representation of the percent of a stream under these types of canopy. As described in the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% is considered fully suitable, and total canopy less than 50% is fully unsuitable for contributing to cool water temperatures that support salmonids.

Chart 1 is useful for interpreting the condition of riparian canopy with respect to vegetation type. The near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature in contact with the stream, which is an important factor in determining stream water temperature. The EMDS watershed scale model considers the status of the nearstream forest component. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter.

Larger streams generally have more open canopy and deeper pools than small streams. This is partially a function of wider stream channels and greater stream energy due to higher discharge during storms. The charts in this section of the report list streams on the vertical axis in descending order by drainage area (largest at the top) in order to allow some resolution on this size factor. By such a presentation, one would expect a trend in canopy cover and pool depth values. Deviations from the expected trend in canopy or pool depth may indicate streams with more suitable or unsuitable canopy or pool depth conditions relative to other streams of that subbasin.

Chart 2 (e.g. Figure NH2) presents cobble embeddedness categories as measured at every pool tail crest. The EMDS Reach Model considers cobble embeddedness greater than 50% to be somewhat unsuitable and 100% to be fully unsuitable for the survival of salmonid eggs and embryos. Chart 2 is useful for examining the distribution of embeddedness values encountered in a stream, and among steams within the subbasin.

Habitat categories by percent survey length are described in **Chart 3** (e.g. Figure NH3) showing the abundance of overall pool, flatwater, and riffle habitats, as well as the percent of a surveyed stream reach that is de-watered, if any, at the time of the survey. During their life history, salmonids require access to all of these types of habitat. EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable.

Chart 4 (e.g. Figure NH4), illustrates the percent length of a survey composed of deeper, high quality pools. The amount of pool habitat of sufficient depth to be fully suitable for anadromous salmonids is considered in the EMDS Reach Model as the percent of primary pools determined by a range of pool depths, depending on the order (size) of the stream. Generally, a reach must have 30 – 55% of its length in these high quality pools for its stream class to be in the suitable ranges (EMDS Table 4).

Chart 5 (e.g. Figure NH5) shows pool shelter rating, which illustrates relative pool complexity, another component of pool quality. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of thirty. The range from 100 to 300 is fully suitable.

The surveyed streams of the Southern Subbasin show percent canopy levels that are rated in the EMDS as completely suitable to somewhat unsuitable for maintaining cool water temperatures, yet are generally the highest among the subbasins (Figure SH1. Percent conifer canopy levels vary from 5% to 31%. Embeddedness values in the Southern Subbasin yield EMDS ratings that vary from somewhat suitable to completely unsuitable for the survival of developing salmonid eggs and embryos (Figure SH2). Most surveyed southern tributaries have 20%-30% pool habitat by length, but five southern streams had less than 20% pool habitat and five have greater than 30% pool (Figure SH3). Most pools in southern streams are relatively shallow, but that the Mattole Headwaters and Stanley Creek stand out as streams with relatively abundant deep pools for their size (Figure SH4). The EMDS Reach Model rates several streams as completely suitable and others as completely unsuitable with regard to pool habitat. Pool shelter ratings in the Southern Subbasin are among the highest in the Mattole basin, but only the Mattole Headwaters scored above 80 to suggest completely suitable pool habitat complexity and cover (Figure SH5).

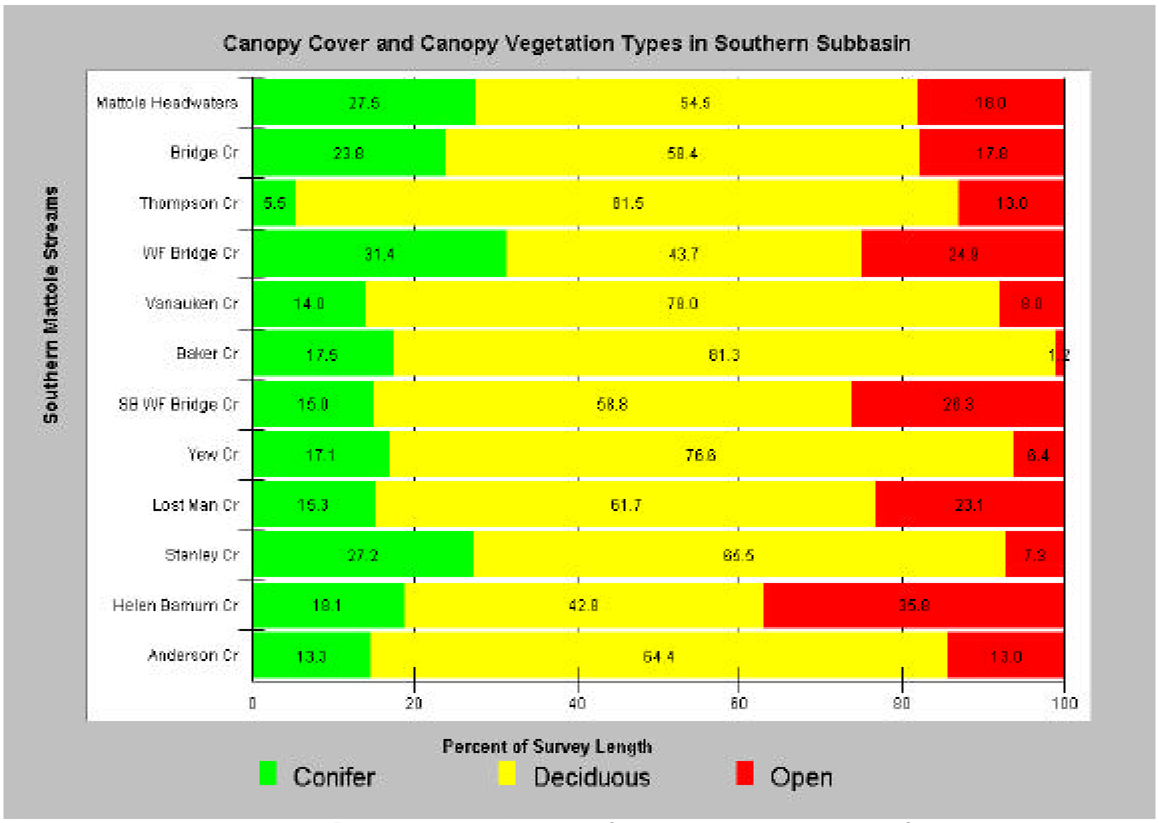

Figure SH1: Canopy cover and canopy vegetation types from DFG stream surveys of the Southern Mattole Subbasin. Chart from KRIS Mattole.

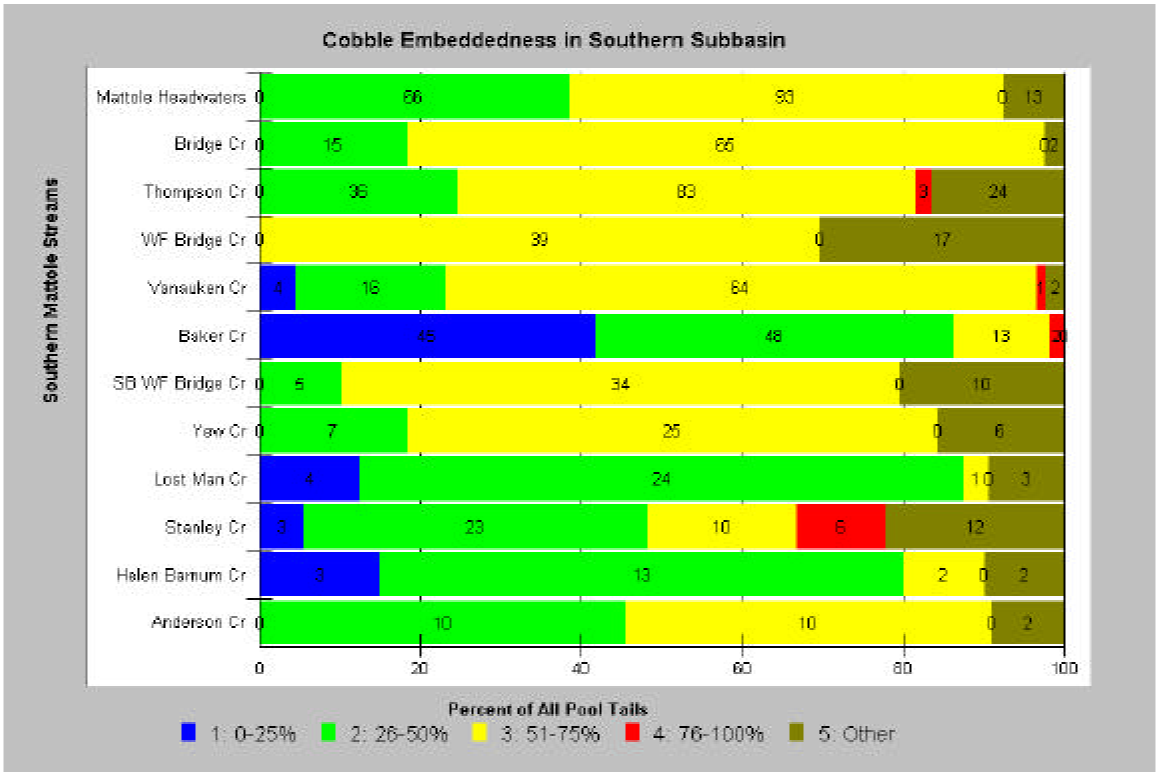

Figure SH2: Embeddedness ratings by occurrence from DFG stream surveys of the Southern Mattole Subbasin. Substrate embeddedness categories in excess of 50% are considered by EMDS to be somewhat unsuitable to fully unsuitable for the survival of salmonid eggs and embryos. Chart includes those pool tails deemed unsuitable for spawning due factors other than embeddedness (e.g., a log sill, etc., Category Five). Chart from KRIS
Mattole.

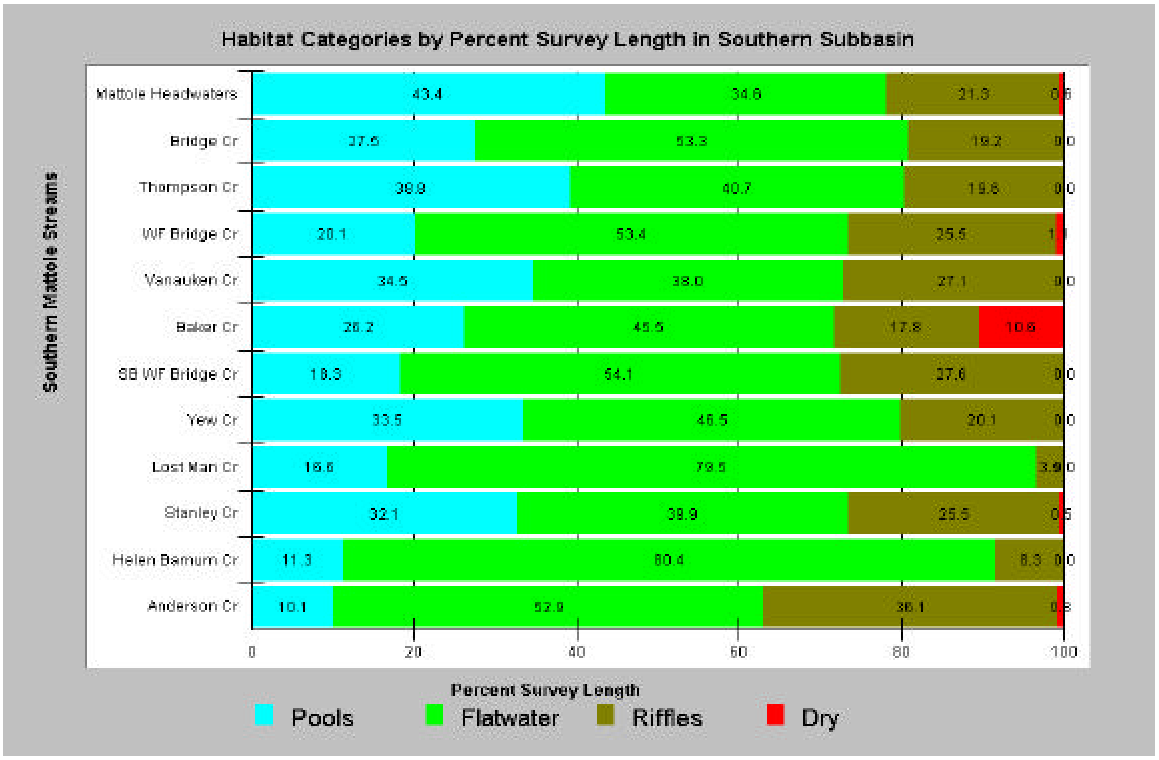

Figure SH3: Habitat types by percent survey length from DFG stream surveys of the Southern Mattole Subbasin. Chart from KRIS Mattole.

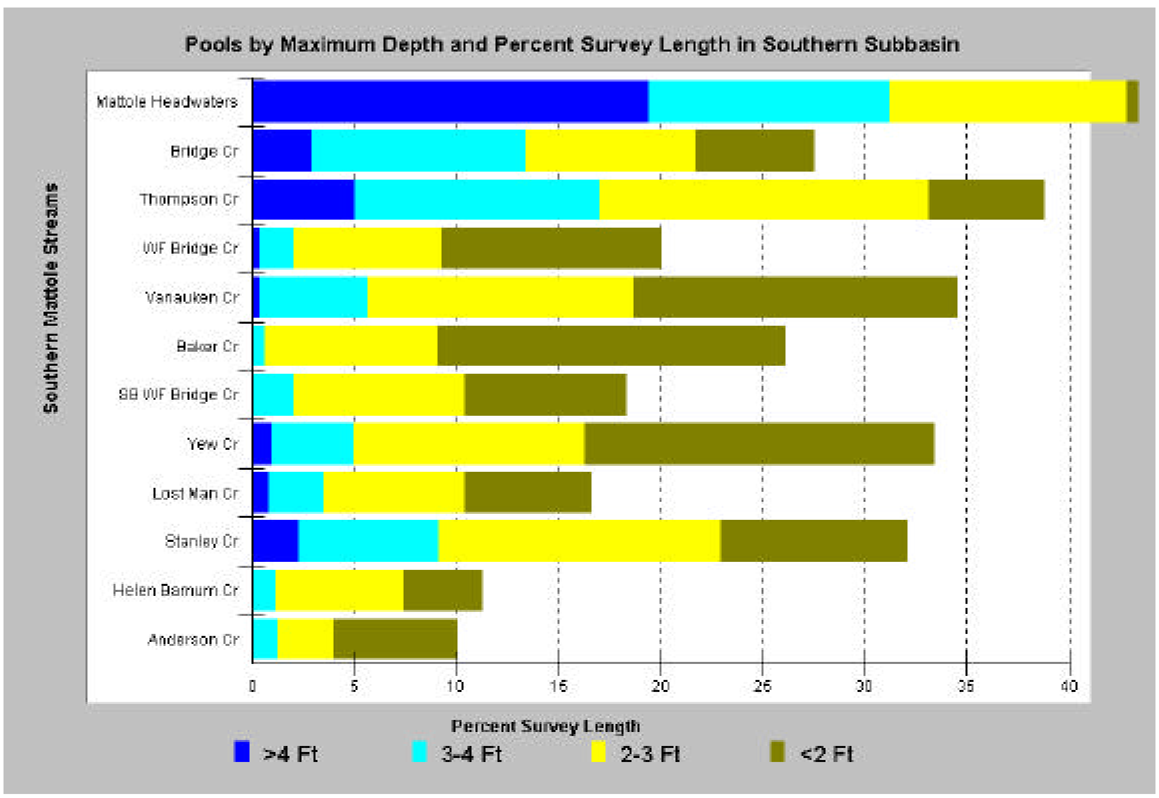

Figure SH4: Pools of various maximum depths by percent total survey length from DFG stream surveys of the Southern Mattole Subbasin. Portrayed values sum to the length of percent pool habitat in Figure SH3. Chart from KRIS Mattole.

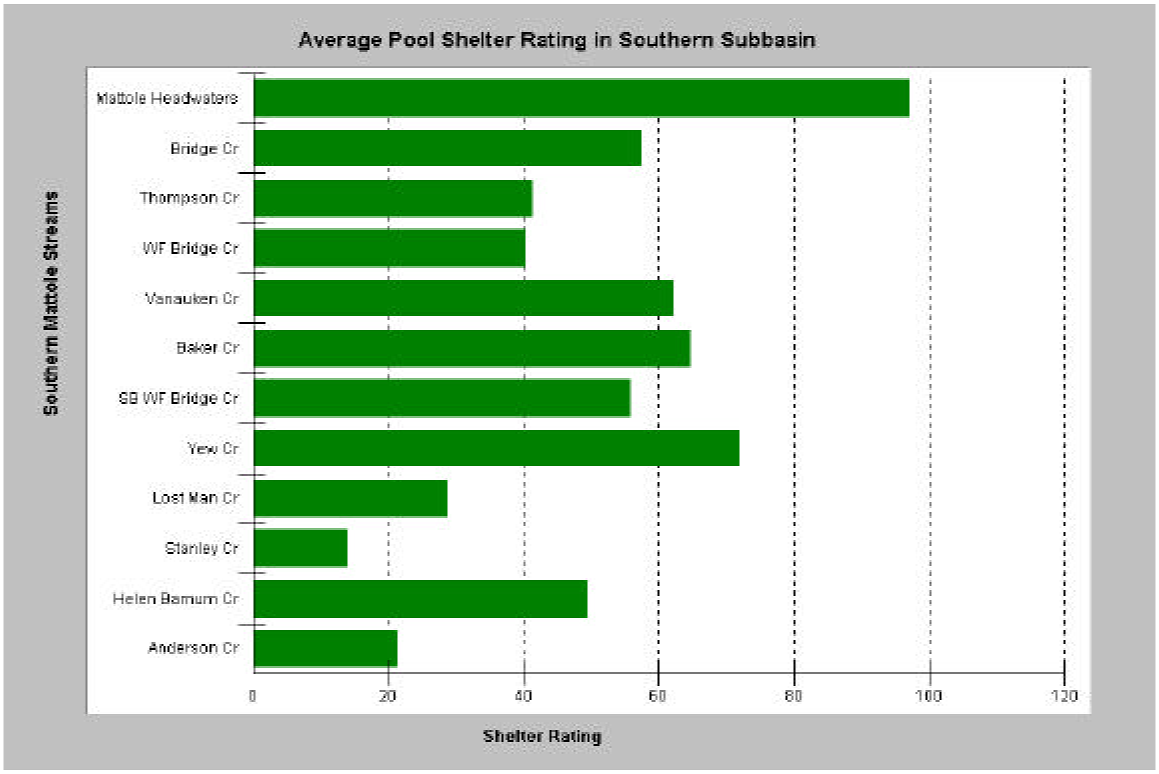

Figure SH5: Average pool shelter ratings from DFG stream surveys of the Southern Mattole Subbasin. An EMDS rating in the range 100-300 is considered fully suitable (X-axis is truncated here). Chart from KRIS Mattole.

Subbasin Trends

The trends for several factors within the Mattole River tributaries in the Southern subbasin can be summarized as follows. The size and density of the riparian zone woody vegetation in privately owned timberlands will increase over time due to timber harvesting plan regulations. Those timberlands owned by the public are withdrawn from management activities and the size and density of the riparian zone woody vegetation is also expected to increase over time. Humboldt County requires new construction set-backs from watercourses that will help preserve existing riparian vegetation, but the clearing of vegetation by landowners as part of rural residential living is not regulated. Mendocino County does not require building set-backs adjacent to streams, but does refer permit applications that the County finds may have environmental concerns to the California Department of Fish and Game. Both counties have additional regulations associated with flood plains and the Coastal Zone. Trends for riparian zones bordered by or containing roads are also unclear. It is possible that some roads may be abandoned and riparian vegetation re-established, but many of the roads are County roads, lead to streamside County roads or access rural residential parcels. Riparian vegetation may be sacrificed in road maintenance activities, both regular and storm induced.

The number of roads within the watershed can be expected to increase as timberlands are harvested for the first time since the application of Forest Practice rules. These rules and current practices generally require road systems located high on the slope unlike earlier timber harvest and transportation systems that established roads low on the slopes, often near streams. Lands recently purchased for the Gilham Butte reserve that will be in Bureau of Land Management (BLM) ownership and management when transactions are complete will have road assessment and inventory evaluation as part of a change in landowner objectives.

The short time period of stream temperature data results and for D50 values, an indicator of fine sediment in the streambed does not allow for any trend analysis. There is no data on suspended sediment.

Relative disturbed stream channel percentages and stream bank erosion during the time period of 1984 to 2000 appeared to be lowest in this subbasin. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one hundred year return events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Subbasin Issues

- The use of herbicides on industrial timber lands is of concern to local residents for both human health and water quality reasons. The impacts of these applications have not been quantified in this planning basin. Further study of this issue would be recommended.

- There is a higher risk of catastrophic fire in this subbasin due to the high density of human inhabitance in proximity to wildlands.

- Limited road assessment and treatment has been completed in this subbasin. These efforts should be expanded because of the potential for further sediment delivery from active and abandoned roads, many of which are in close proximity to stream channels.

- There is high impact on land in this area from road density, human habitation, human waste disposal, land disturbance from building of structures, land modification, and water accumulation and run-off patterns.

- Excessive extraction of water from springs, tributaries, and the mainstem during summer low flow periods may be extremely detrimental to fish survival, particularly in drought years.

- Water temperatures in this planning basin are favorable for summer rearing of juvenile salmonids. Recent instream sediment sampling data indicates that there are continuing input of fine sediments, but this does not appear to be a major limiting factor for salmonid production.

- Adequate canopy shade is reflected by suitable water temperatures in most streams for summer rearing of juvenile salmonids. The best remaining habitat in the Mattole basin is found in this area. This translates to the highest fish productivity rate in the Mattole basin.

- Fish density appears to be adequate relative to habitat conditions.

- Very high loading of instream of large woody debris has been enhanced by restoration projects since 1996. Future natural recruitment potential for large woody debris is higher in this area because substantial riparian areas along the mainstem are devoted to conservation purposes.

- The DFG has conducted analysis on macroinvertebrate data collected by the BLM since 1996 on six subbasin streams. The results show the samples were either fair to good, or good in terms of overall conditions. Additional data for aquatic macroinvertebrate productivity would be useful for effectiveness monitoring purposes.

- There is no available data on pH, DO, nutrients, etc.

- Removal of in-stream large woody debris by the DFG and the California Conservation Corps occurred in about twenty-one miles of streams in this subbasin during the 1980's. A total of 36,800 cubic feet of wood was removed. This is equivalent to 294 logs 2' x 40'. This activity likely had adverse local impacts on salmonid habitat conditions. Beginning in 1996, a series of DFG funded instream enhancing projects by the Mattole Salmon Group have restored much of the complexity by the addition of large woody debris to key stream reaches.

- Wildlife/Plants -- Inadequate information exists to assess the status and trends of flora and fauna, including invasive species.

- Opportunities for public recreation in this area are available but limited.

- A major salmonid rearing facility exists in the headwaters, operated since 1982 by the Mattole Salmon Group. This operation has been successful and should be continued in order to supplement wild populations of chinook salmon.

- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

Subbasin Issue Synthesis

Working Hypothesis 1: *Watershed and stream conditions are the most supportive of salmonids in the Mattole Basin.*

Supportive Findings:

- All three species of the Mattole Basin's anadromous salmonids are present in tributaries to the Mattole River in this subbasin.

- In general, MWATs in the Southern subbasin are tightly aggregated in the high 50 to low 60ºF range.

- The DFG Coho Assessment Project found coho in three subbasin tributaries in 2001.

- V* was 0.04 in Bridge Creek in 2000, which is exceptionally low and may indicate low sediment production due to few, if any, upslope disturbances or rapid sediment transport through well armored pools that may experience high rates of scour during storms.

- The DFG has conducted analyses on macroinvertebrate data collected by BLM since 1996 on six subbasin streams. The results show the samples were either fair to good, or good in terms of overall conditions.

Contrary Findings:

- The mainstem Mattole River in this subbasin is intermittent and dewatered above the confluence with Mill Creek.

Working Hypothesis 2: ***Some reaches of stream in the subbasin are not fully supportive of salmonids due to stream flow reductions related to human diversion.***

Supportive Findings:

- Data from the 2000 Census shows that Southern subbasin has the most concentrated human population in the Mattole Basin at 7.4 people per square mile and that most of them are concentrated along the upper Mattole River and its major tributaries.

- Field observations indicate that intermittent flow and dewatering of the mainstem Mattole headwaters area (above Whitethorn) occurs in dry years.

Recommendations:

7. Ensure that this high quality habitat is protected from degradation.

8. Encourage reducing the unnecessary and wasteful use of water to improve river flows and fish habitat.

9. Monitor 24 hour summer water and air temperatures to detect trends using continuous monitoring thermographs.

10. Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.

11. Encourage the use of cable or helicopter yarding on steep and unstable slopes to reduce soil compaction, surface disturbance and resultant sediment yield.

12. Continue efforts such as road improvements and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.

Western Mattole Subbasin

Introduction

The "Western" subbasin is located between the Bear Creek in the estuary (River Mile 0.3) and the headwaters of the South Fork of Bear Creek (River Mile 50) along the western side of the Mattole mainstem and Wilder Ridge for a distance of about sixty miles (see map on the following page). There are thirty perennial streams that drain a watershed area of 89 square miles. The DFG has recently surveyed 41.5 miles of the subbasin's anadromous reaches. Elevations range from 20' at the estuary to approximately 2,800' in the headwaters of the tributaries in the King Range. Kings Peak, at 4,087' is the highest point in the Mattole River basin.

Climate

The Western subbasin is greatly influenced by the King Range which is its western boundary. Temperatures have a wide range because the mountains cut off the moderating effect produced by marine air. Precipitation totals vary from 70 to 100 inches annually.Rainfall averages are highest in the center of this subbasin because the greatest orographic effect occurs here due to the presence of the King Ranges' tallest peaks.

Hydrology

The Western subbasin is made up of six complete Calwater Units and most of the Shennanigan Ridge Calwater Unit (map on the following page). There are 85.8 perennial stream miles in 30 perennial tributaries in this subbasin (Table 17). Twelve of these tributaries have been inventoried by the DFG. There were 25 reaches, totaling 41.5 miles in the inventory surveys. The inventories included channel and habitat typing, and biological sampling.

In their inventory surveys, the DFG crews utilize a channel classification system developed by David Rosgen (1994) and described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al., 1998). Rosgen channel typing describes relatively long stream reaches using eight channel features: channel width, depth, velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment size. There are eight general channel types in the Rosgen classification system.

In the Western subbasin, there were two type A channels, totaling 2.2 miles; seven type B channels, totaling 17.3 miles; and 12 type F channels, totaling 21.8 miles. Type A stream reaches are narrow, moderately deep, single thread channels. They are entrenched, high gradient reaches with step/pool sequences. Type A reaches flow through steep V- shaped valleys, do not have well-developed floodplains, and have few meanders. Type B stream reaches are wide, shallow, single thread channels. They are moderately entrenched, moderate to steep gradient reaches, which are riffle-dominated with step/pool sequences. Type B reaches flow through broader valleys than type A reaches, do not have well-developed floodplains, and have few meanders. Type F stream reaches are wide, shallow, single thread channels. They are deeply entrenched, low gradient reaches and often have high rates of bank erosion. Type F reaches flow through low-relief valleys and gorges, are typically working to create new floodplains, and have frequent meanders (Flosi, et al., 1998).

Insert Western Subbasin Map here.

Table 22 Surveyed Streams with Estimated Anadromy in the Western Subbasin

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
Bear Creek	N		0.3		
Stansberry Creek	N		0.5		
Mill Creek (lower)	Y	1.1	1.4	1	B2
Clear Creek	N		0.7		
Indian Creek	N		1.2		
Wild Turkey Creek	N		0.1		
Green Fir Creek	N				
Squaw Creek	Y	4.1	12.7	1	F3
Granny Creek	N				
Cook Gulch	N				
Saunders Creek	N		0.4		
Hadley Creek	N				
Kendall Gulch	N				
Woods Creek	N		1.5		
Bundle Prairie Creek	N				
Honeydew Creek	Y		5.9		
	Y	1.4		1	F4
	Y	0.9		2	F4
	Y	1.1		3	F3
	Y	0.7		4	A2
Bear Trap Creek	Y		0.1		
	Y	2.9		1	F3
	Y	1.7		2	F2
	Y	1.6		3	B2
	Y	1.1		4	F2
High Prairie Creek	N		0.6		
East Fork Honeydew Creek	Y	2.9	6.0	1	F2
Upper East Fork Honeydew Creek	Y	1.0	0.0	1	F2
West Fork Honeydew Creek	Y	0.7	0.2	1	B2
Bear Creek	Y		6.5		
	Y	1.4		1	B2
	Y	0.3		2	A2
French Creek	N		0.4		
Jewett Creek	N		2.4		
North Fork Bear Creek	Y		4.3		
	Y	2.5		1	B4

Stream	DFG Survey (Y/N)	DFG Survey Length (miles)	Estimated Anadromous Habitat Length (miles)	Reach	Channel Type
	Y	0.9		2	A3
Unnamed Tributary to North Fork Bear Creek	Y	1.4		1	B2
	Y	0.3		2	A2
South Fork Bear Creek	Y		10.7		
	Y	1.9		1	B2
	Y	4.6		2	F3
	Y	5.3		3	B3
	Y	0.3		4	F4
Little Finley	N				
Big Finley	N		0.1		
Nooning	Y		1.5		
	Y	0.1		1	F3
	Y	1.4		2	B2

Insert CCC large woody debris Table here.

Geology

The geology of the Western subbasin is highly variable but, with respect to slope stability, may by generally characterized as less stable in the easterly and northerly areas. The Southern portion of the Western subbasin straddles the northwest-trending boundary between the King Range terrane on the west and the Coastal terrane to the east. The Lower North Fork and South Fork of Bear Creek and Lower East Fork of Honeydew Creek are subsequent streams that follow the zone of faulting and shearing associated with the structural suture between the two geologic terranes. Large dormant landslide complexes overprinted with more limited active landslides are found in association with the highly sheared bedrock present along these stream reaches. To the west, the dramatic relief and steep slopes of the King Range are a reflection of relatively intact and stable bedrock underlying the middle of the mountain range coupled with rapid, on-going regional uplift. The relatively few deep-seated landslides mapped along the eastern flanks of the King Range appear to be dormant. Abundant debris slide slope and inner gorge geomorphic features have been mapped in this area, along with a moderate number of active debris slide scares concentrated adjacent to drainages. West of Honeydew and in the upper reaches of Squaw Creek, bedrock is pervasively disrupted along the broad, west-trending Cooskie shear zone that forms the northern boundary of the King Range terrane. Large deep-seated landslides, historically active earthflows, and gully erosion on grass-covered highlands have been mapped in association with the weakened bedrock in this area of the subbasin.

Vegetation

This section is under development.

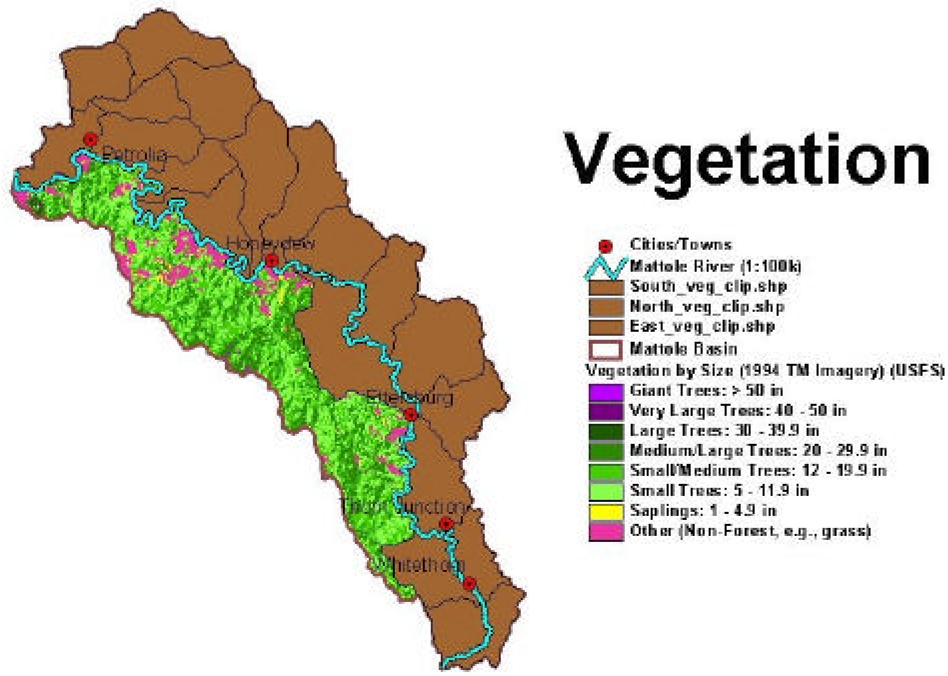

Figure 37: Vegetation of the Western Subbasin.

Land Use

The subbasin is largely in public ownership managed by the Bureau of Land Management (BLM) as part of the King Range National Conservation Area (KRNCA) (Figure 38). The area has a relatively small amount of subdivision and ranching. The small towns of Ettersburg and Honeydew are the areas where most private land is located in this subbasin. Controversy over BLM management and public access to the resources of the KRNCA, both supportive and critical, are ongoing issues. Timber harvest issues have occurred in the past, focused on stands in Honeydew Creek, but now most of timber is now managed for late seral reserve (Table 14). The 220 acre Mill Creek Forest, the last old-growth Douglas fir and tan oak forest in the lower Mattole, is located in the lowest downstream part of this subbasin.

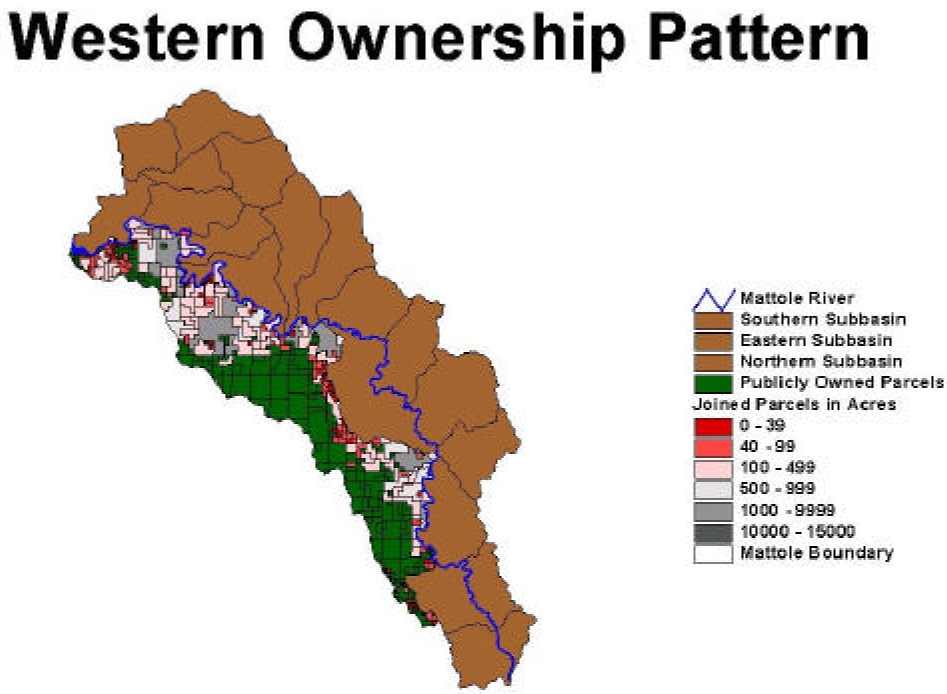

Figure 38: Ownership Pattern of the Western Subbasin.

Table 23: Timber Harvest History, Western Mattole Subbasin.

TIMBER HARVEST HISTORY - WESTERN MATTOLE SUBBASIN		
	Total Acres	Percent of Area
Harvested 1945-1961	20,544	36%
Harvested 1962-1974	5,222	9
Harvested 1975-1983	1,584	3
Harvested 1984-1989	540	1
Harvested 1990-1999	213	<1
Harvested 2000-2001 (partial)	0	0

Fluvial Geomorphology

The fluvial geomorphology of the Western subbasin is characterized by a highly variable percentage of disturbed channel and stream bank erosion throughout the subbasin. Table 4 (still under development) illustrates the range in percent disturbed channel for the 1984 and 2000 aerial photographs, and illustrates the variable nature. Areas with a high percentage of disturbed channel include portions of streams within the Honeydew Creek and North Fork Bear Creek planning watersheds. The North Fork Bear Creek planning watershed is noteworthy because in certain areas it has shown over a 40 percent decrease in disturbed channel. Areas with a lower percentage of disturbed channel include portions of streams within the Shenanigan Ridge and Woods Creek planning watersheds. These areas with a lower percentage of disturbed channel have remained relatively constant with respect to time.

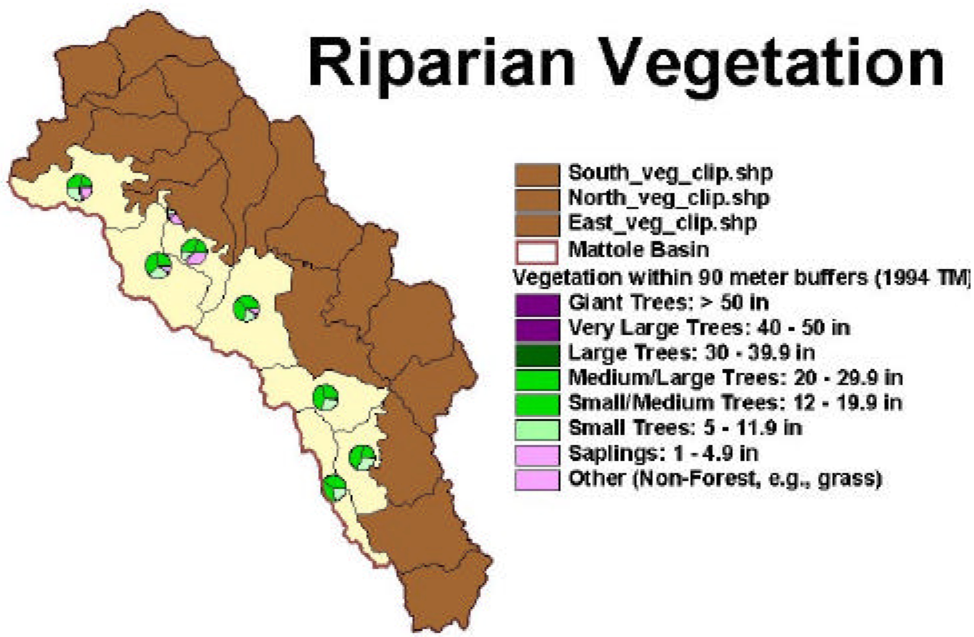

Figure 39: Riparian Vegetation of the Western Subbasin.

The following two vegetation comparisons are for the Big Finley planning watershed that experienced a catastrophic wildfire in 1974 and the Shenanigan Ridge planning watershed that includes the western side of the lower Mattole River and Mill Creek, a small watershed in the lower Mattole containing about 200 acres of old-growth Douglas-fir, coho, and cool water temperatures (Figures 39-43).

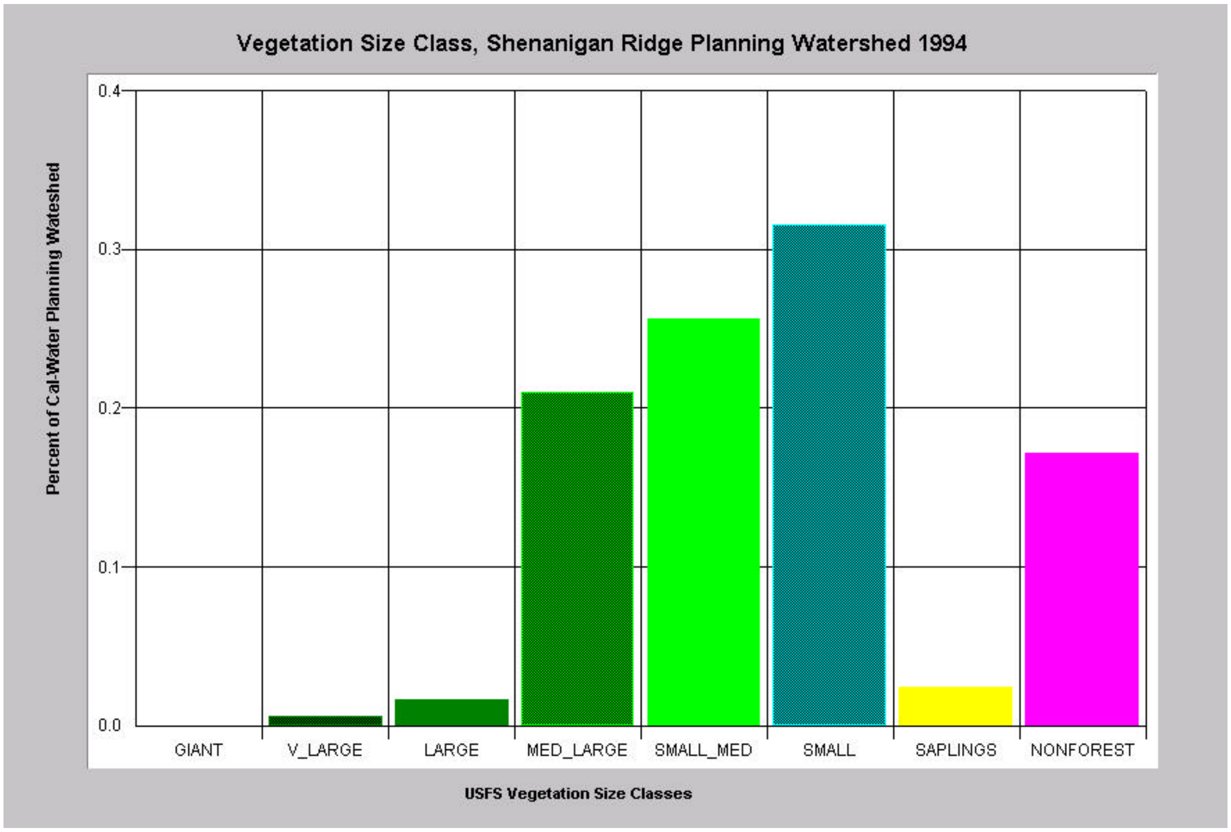

Figure 40: Vegetation Size Class, Shenanigan Ridge Planning Watershed 1994.

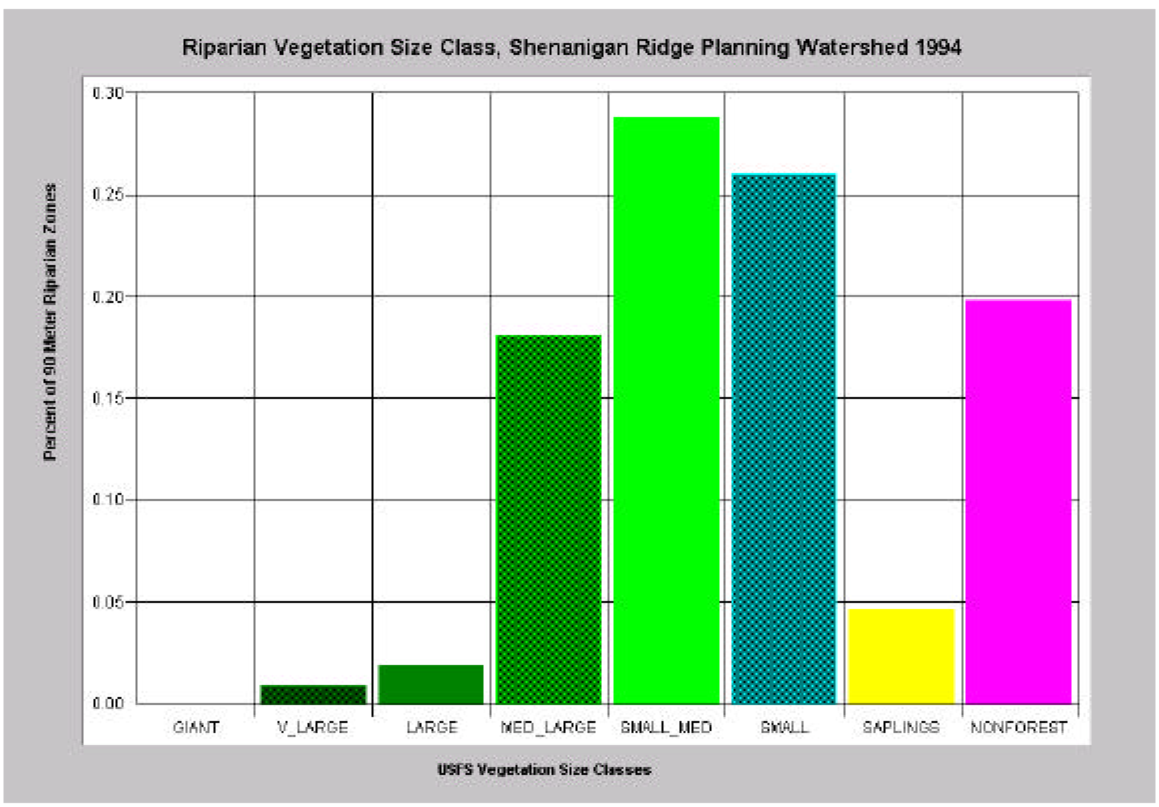

Figure 41: Riparian Vegetation Size Class, Shenanigan Ridge Planning Watershed 1994.

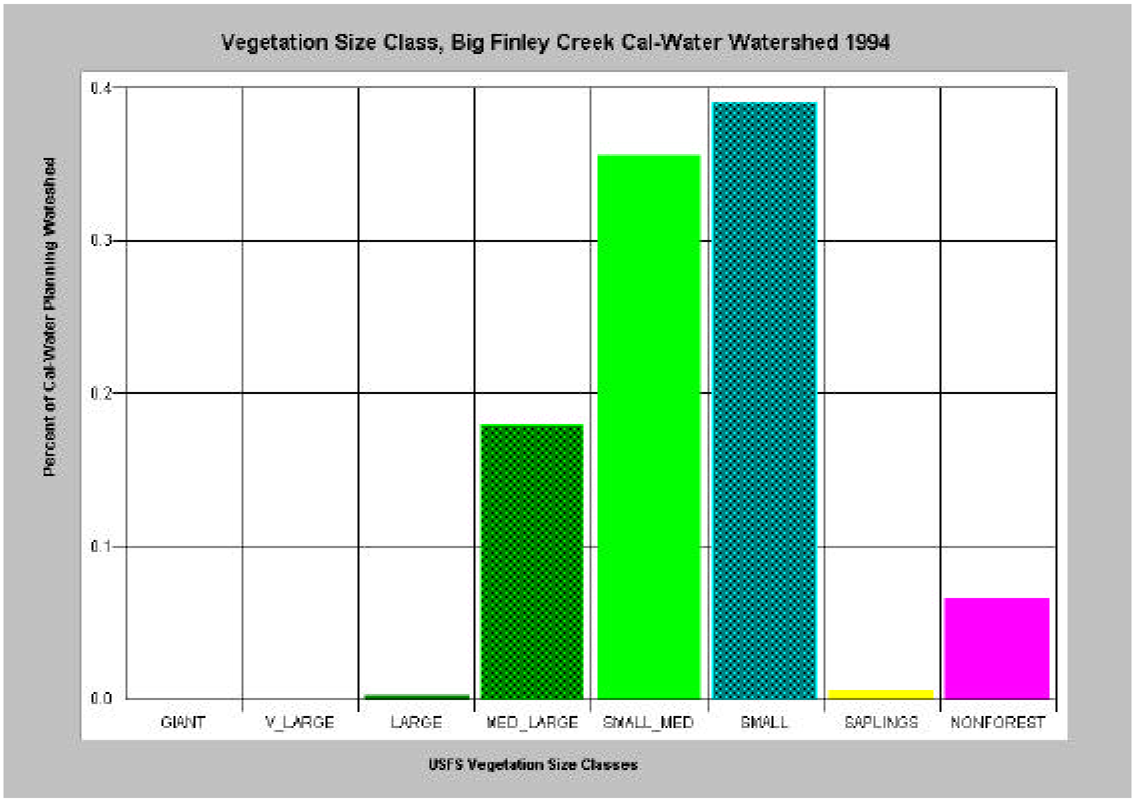

Figure 42: Vegetation Size Class, Big Finley Creek Planning Watershed 1994.

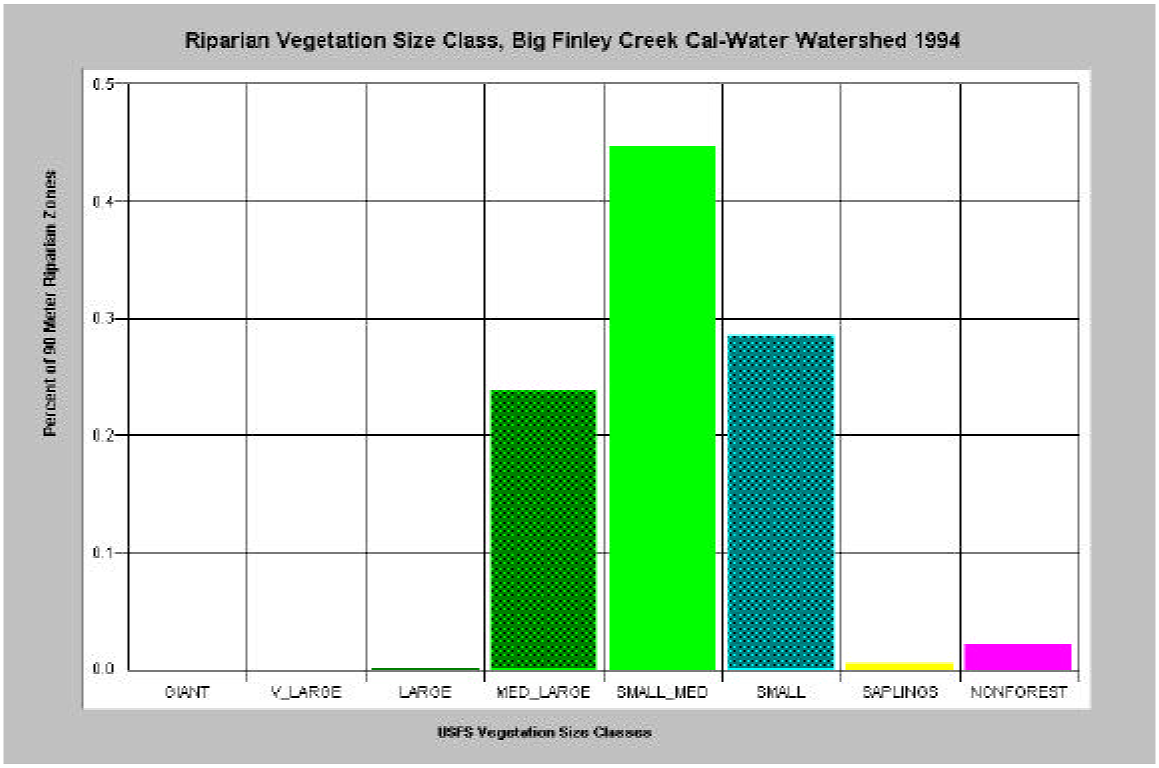

Figure 43: Riparian Vegetation Size Class, Big Finley Creek Planning Watershed 1994.

Fish History and Status

All three anadromous salmonid species are present. In 2001, the DFG Coho Assessment Project staff observed coho in four streams in this subbasin. The upper reaches the three major tributaries in this basin are considered good refugia, and this will continue due to BLM ownership and management of key headwater reaches. Fish populations are low at this time, but are expected to increase due to public stewardship within the basin. Very little data exists on fish density in this planning basin. Further study of this issue is recommended.

Fish Habitat Relationship

The subbasin supports populations of chinook and coho salmon, and steelhead. In 2001, the DFG coho project snorkel surveys found coho salmon in two subbasin tributaries. Coho have been observed in five other tributaries in recent years by the DFG Restoration staff. Most tributaries support strong, multi-year class juvenile steelhead rearing populations based upon recent DFG stream surveys. Most tributaries have favorable summer water temperatures for summer rearing habitat, and adult spawning conditions are variable but generally favorable.

Fish Passage Barriers

Nine stream crossings were surveyed in the Western Subbasin as a part of the Humboldt County culvert inventory and fish passage evaluation conducted by Ross Taylor and Associates (2000). Lighthouse Road near Petrolia has culverts on Bear Creek, Mill Creek, Stansberry Creek, and Titus Creek; the Mattole Road between Petrolia and Honeydew has culverts on Clear Creek, Granny Creek, Indian Creek and Saunders Creek; and Wilder Ridge Road has a culvert on High Prairie Creek. The culverts on Bear Creek, Clear Creek, High Prairie Creek, Stansberry Creek, and Titus Creek were found to be total salmonid barriers and the culverts on Indian Creek and Saunders Creek were found to be partial salmonid barriers (Table X.). The culverts on Granny Creek and Mill Creek were found to be temporary and partial salmonid barriers. In a list of priority rankings of 67 culverts in Humboldt County for treatment to provide unimpeded salmonid passage to spawning and rearing habitat, rankings of culverts in the Western Subbasin ranged from 5 for Stansberry Creek to 64 for Granny Creek. Criteria for priority ranking included salmonid species diversity, extent of barrier present, culvert risk of failure, current culvert condition, salmonid habitat quantity, salmonid habitat quality, and a total salmonid habitat score. The culvert on Mill Creek is scheduled for improvements in 2002, the culvert on Clear Creek was improved in 2001, the culvert on Stansberry Creek was proposed and scheduled for improvement in 2001 but funding ran out, and the culvert on Saunders Creek is currently proposed for improvement (G. Flosi, personal communication).

Table 24: 21 Culverts Surveyed for Barrier Status in the Western Subbasin (Taylor, 2000; G. Flosi, Personal Communication

Stream Name	Road Name	Priority Rank	Barrier Status	Upstream Habitat	Treatment
Bear Creek	Lighthouse Road	15	Total barrier. Excessive under sizing probably creates a velocity barrier.	0.3 miles of potential salmonid habitat.	None proposed at this time
Clear Creek	Mattole Road	7	Total barrier. An extremely steep gradient creates a total velocity barrier. Parallel steel tracks probably contribute to passage problems by increasing velocities, as they have minimal roughness, and interfering with a fish's swimming motion.	0.7 miles of good salmonid habitat.	Improved in 2001
Granny Creek	Mattole Road	64	Temporary and partial barrier. This culvert is a partial/temporary barrier for adult steelhead (only 20% passable) and a complete barrier for adult coho and all juveniles. Water levels are too shallow at low flows, and excessive velocities exist at higher flows. Both excessive slope and the long length of the culvert cause passage problems.	0.7 miles of poor salmonid habitat.	None proposed at this time
High Prairie Creek	Wilder Ridge Road	50	Total barrier. The culvert is a complete barrier for all adults and juveniles. Water levels are too shallow at low flows, and excessive velocities exist at higher flows. Both excessive slope and a smooth floor cause passage problems. The baffles are poorly installed, and flow is turbulent and fast during even moderate runoff. The outlet pool is not deep enough for salmonids to jump into the culvert.	1.4 miles of poor salmonid habitat.	None proposed at this time
Indian Creek	Mattole Road	13	Partial barrier. Partial barrier for adults, nearly complete barrier for juveniles. Water levels are too shallow at low flows, and excessive velocities exist at higher flows. Direct observation of juveniles suggests that the entry jump and flow velocities were problems. Kingfishers were observed at the outlet pool when juvenile steelhead were jumping.	1.2 miles of good salmonid habitat.	None proposed at this time
Mill Creek	Lighthouse Road	20	Temporary and partial barrier. A temporary barrier for adults. Excessive velocities at higher migration flows exist. A barrier for juveniles. An excessive jump is required to enter the culvert and velocities appear excessive even with baffles.	1.35 miles of good salmonid habitat.	Funded and scheduled for improvement in 2002
Saunders Creek	Mattole Road	16	Partial barrier. Partial barrier for adult steelhead (only 24% passable) and a complete barrier for adult coho and all juveniles. Water levels are too shallow at low flows and excessive velocities exist at higher flows. Both excessive slope and a smooth floor cause passage problems. Juveniles were observed failing to swim even several feet up the culvert due to velocity. Measured velocities were 10-12 ft per second during a low-moderate winter migration flow.	0.7 miles of fair salmonid habitat.	Proposed for improvement
Stansberry Creek	Lighthouse Road	5	Total barrier. An excessive jump is required to enter the culvert, while there is a lack of depth to execute such a jump. A steep gradient and excessive under sizing creates a velocity barrier.	0.7 miles of potential salmonid habitat.	Proposed and Funded for improvement in 2001, but lack of funding postponed improvements
Titus Creek	Lighthouse Road	46	Total barrier. Steep gradient, length and excessive under sizing create a velocity barrier.	0.4 miles of poor salmonid habitat.	None proposed

Salmonid Habitat Charts

The Department of Fish and Game conducted salmonid habitat surveys in 51 tributary streams of the Mattole watershed in the period 1991-1999 following methods described by the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1991, 1998). Of the several stream attributes collected, those used in the NCWAP Ecological Management Decision Support system model in assessing stream reach conditions of salmonid habitat are canopy cover, embeddedness, percent pools, pool depth, and pool shelter. These habitat attributes are presented in the Analysis and Results by Subbasin section of this report as graphical bar charts. The bar charts were prepared in KRIS Mattole and present summary data for each surveyed stream. All the habitat attributes presented in bar charts are interpreted using the response curves operating in the EMDS Stream Reach Model. The EMDS values used for assigning these ratings are given in Table EMDS 4, in this report's Program and Introduction Section.

These graphics present the same data used in the EMDS Stream Reach Model, but summarize those data for an entire stream where more than one reach was surveyed. Of the Mattole streams surveyed, 12 had two reaches surveyed, three had three reaches surveyed, two had four reaches surveyed, and one had five reaches surveyed. Four streams where surveys covered less than 1000' feet were not included in the bar charts due to concerns about low sample size.

Five charts are presented in the same order and format in four Subbasin Results sections of this report. **Chart 1** (e.g. Figure NH1, Figure WH1) presents the relative percent conifer canopy, deciduous canopy, and open canopy (no canopy) above surveyed streams. Canopy cover, and the relative cover by coniferous versus deciduous trees were measured at each habitat unit during DFG stream surveys. Chart 1 presents averages weighted by unit length to give the most accurate representation of the percent of a stream under these types of canopy. As described in the EMDS response curves, total canopy (sum of conifer and deciduous canopy) exceeding 85% is considered fully suitable, and total canopy less than 50% is fully unsuitable for contributing to cool water temperatures that support salmonids.
Chart 1 is useful for interpreting the condition of riparian canopy with respect to vegetation type. The near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature in contact with the stream, which is an important factor in determining stream water temperature. The EMDS watershed scale model considers the status of the nearstream forest component. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter.

Larger streams generally have more open canopy and deeper pools than small streams. This is partially a function of wider stream channels and greater stream energy due to higher discharge during storms. The charts in this section of the report list streams on the vertical axis in descending order by drainage area (largest at the top) in order to allow some resolution on this size factor. By such a presentation, one would expect a trend in canopy cover and pool depth values. Deviations from the expected trend in canopy or pool depth may indicate streams with more suitable or unsuitable canopy or pool depth conditions relative to other streams of that subbasin.

Chart 2 (e.g. Figure NH2) presents cobble embeddedness categories as measured at every pool tail crest. The EMDS Reach Model considers cobble embeddedness greater than 50% to be somewhat unsuitable and 100% to be fully unsuitable for the survival of salmonid eggs and embryos. Chart 2 is useful for examining the distribution of embeddedness values encountered in a stream, and among steams within the subbasin.

Habitat categories by percent survey length are described in **Chart 3** (e.g. Figure NH3) showing the abundance of overall pool, flatwater, and riffle habitats, as well as the percent of a surveyed stream reach that is de-watered, if any, at the time of the survey. During their life history, salmonids require access to all of these types of habitat. EMDS does not evaluate the ratio of these habitat types, but a balanced proportion is desirable.

Chart 4 (e.g. Figure NH4), illustrates the percent length of a survey composed of deeper, high quality pools. The amount of pool habitat of sufficient depth to be fully suitable for anadromous salmonids is considered in the EMDS Reach Model as the percent of primary pools determined by a range of pool depths, depending on the order (size) of the stream. Generally, a reach must have 30 – 55% of its length in these high quality pools for its stream class to be in the suitable ranges (EMDS Table 4).

Chart 5 (e.g. Figure NH5) shows pool shelter rating, which illustrates relative pool complexity, another component of pool quality. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of thirty. The range from 100 to 300 is fully suitable.

The surveyed streams of the Western Subbasin show percent canopy levels (45%-90% total canopy) that vary in their EMDS rating from completely unsuitable to completely suitable (Figure WH1). Canopy conditions generally trend with stream size, but the South Fork Bear Creek, Mill Creek, and Nooning Creek have exceptionally high total canopy cover, while a tributary to Bear Creek, and Bear Trap Creek have exceptionally low total canopy cover. Existing canopy is dominated by deciduous trees in this subbasin. Embeddedness values in the Western Subbasin are somewhat unsuitable or worse for the survival of developing salmonid eggs and embryos with the exception of Bear Creek and its tributaries where somewhat suitable conditions do exist (Figure WH2). Most surveyed Western Subbasin streams have less than 20% pool habitat by length (Figure WH3). The frequency of deeper pools (Figure WH4) yields EMDS ratings that vary from completely unsuitable to completely suitable. Pool depth is generally higher than for any other Mattole subbasin. Pool shelter ratings in the Western Subbasin yield EMDS ratings that vary from completely unsuitable to completely suitable (Figure WH5).

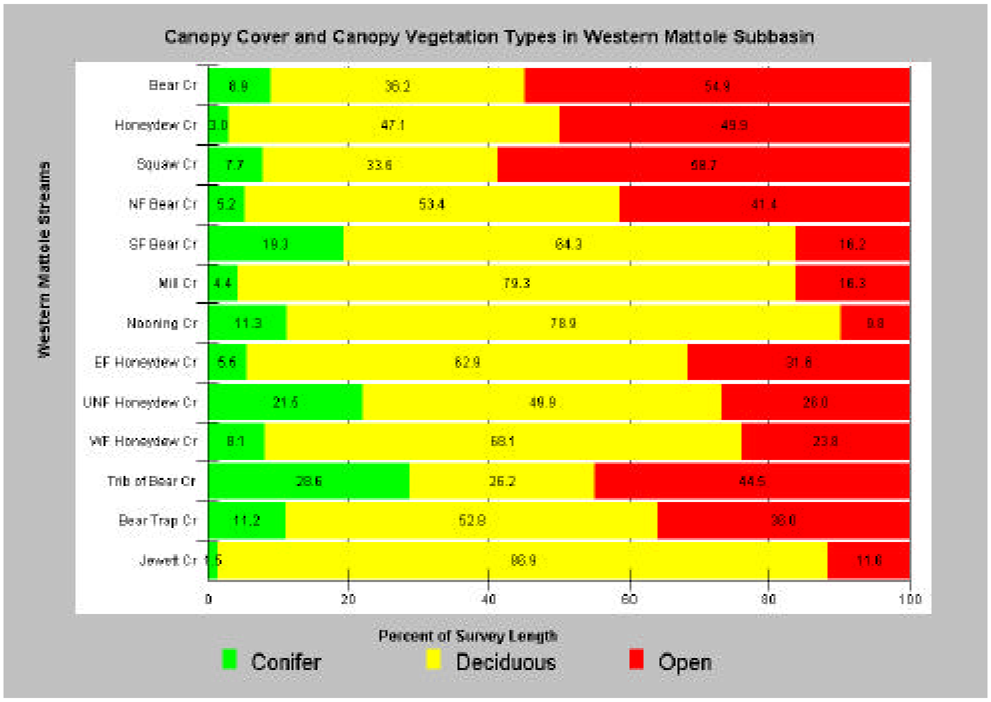

Figure WH1: Canopy cover and canopy vegetation types from DFG stream surveys of the Western Mattole Subbasin. Chart from KRIS Mattole.

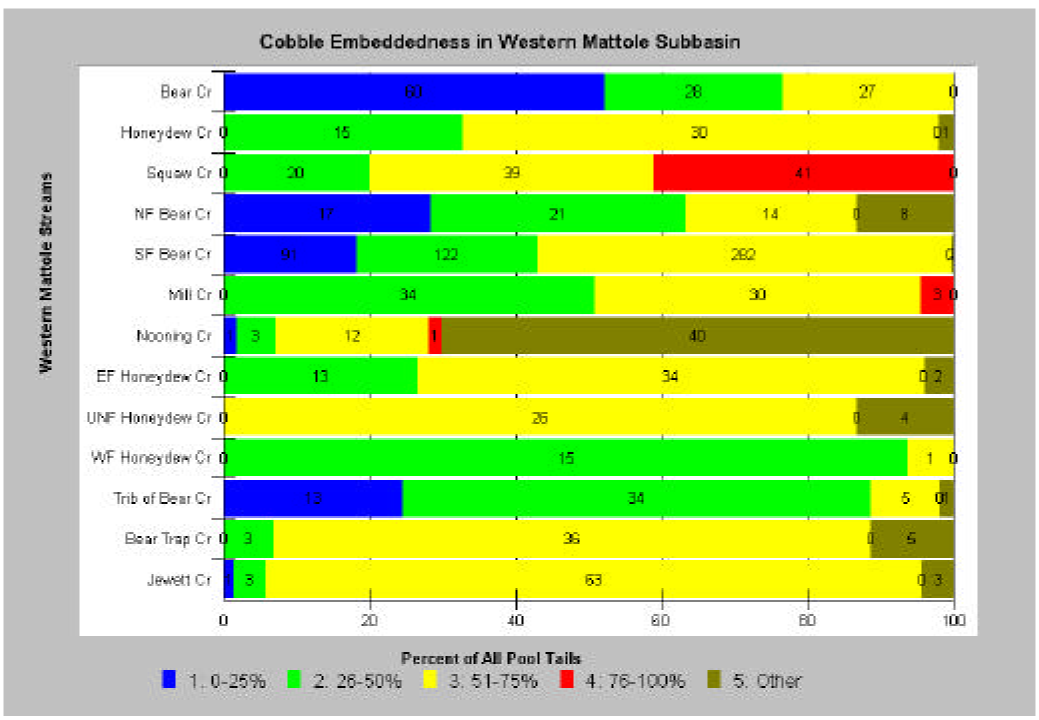

Figure WH2: Cobble embeddedness and spawning unsuitability from DFG stream surveys of the Western Mattole Subbasin. Substrate embeddedness categories in excess of 50% are considered by EMDS to be somewhat unsuitable to fully unsuitable for the survival of salmonid eggs and embryos. Chart includes those pool tails deemed unsuitable for spawning due factors other than embeddedness (e.g., a log sill, etc., Category Five). Chart from KRIS Mattole.

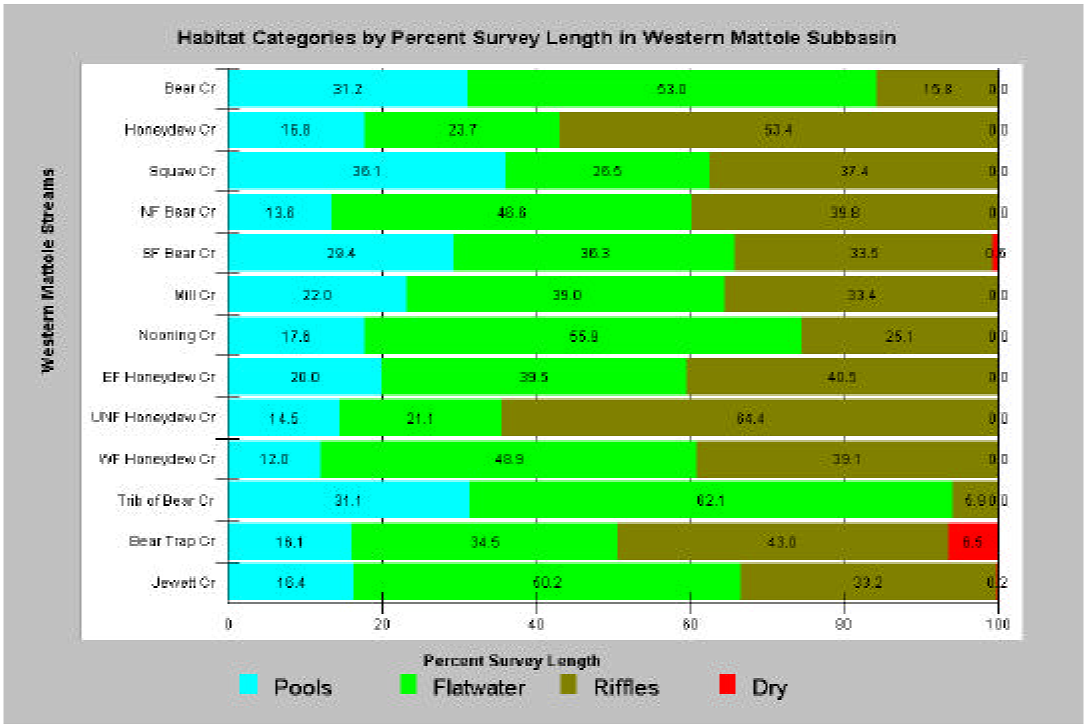

Figure WH3: Habitat categories by percent survey length from DFG stream surveys of the Western Mattole Subbasin. Chart from KRIS Mattole.

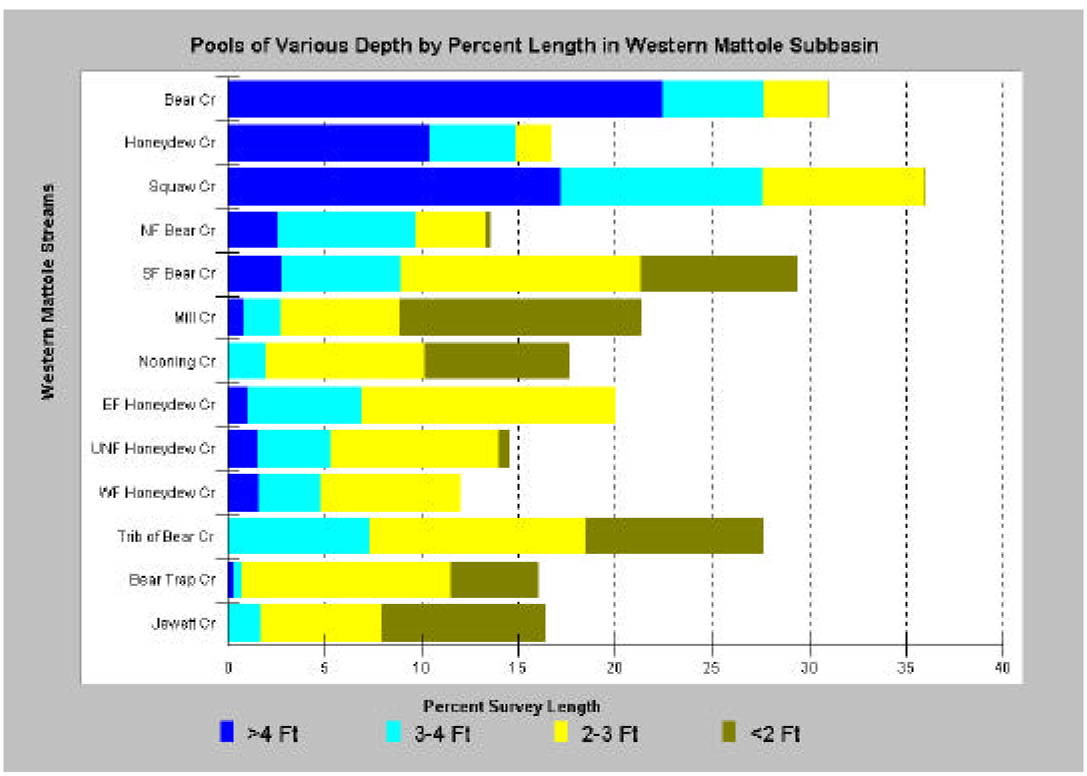

Figure WH4: Pools by maximum depth and percent survey length from DFG stream surveys of the Western Mattole Subbasin. Portrayed values sum to the length of percent pool habitat in Figure WH3. Chart from KRIS Mattole.

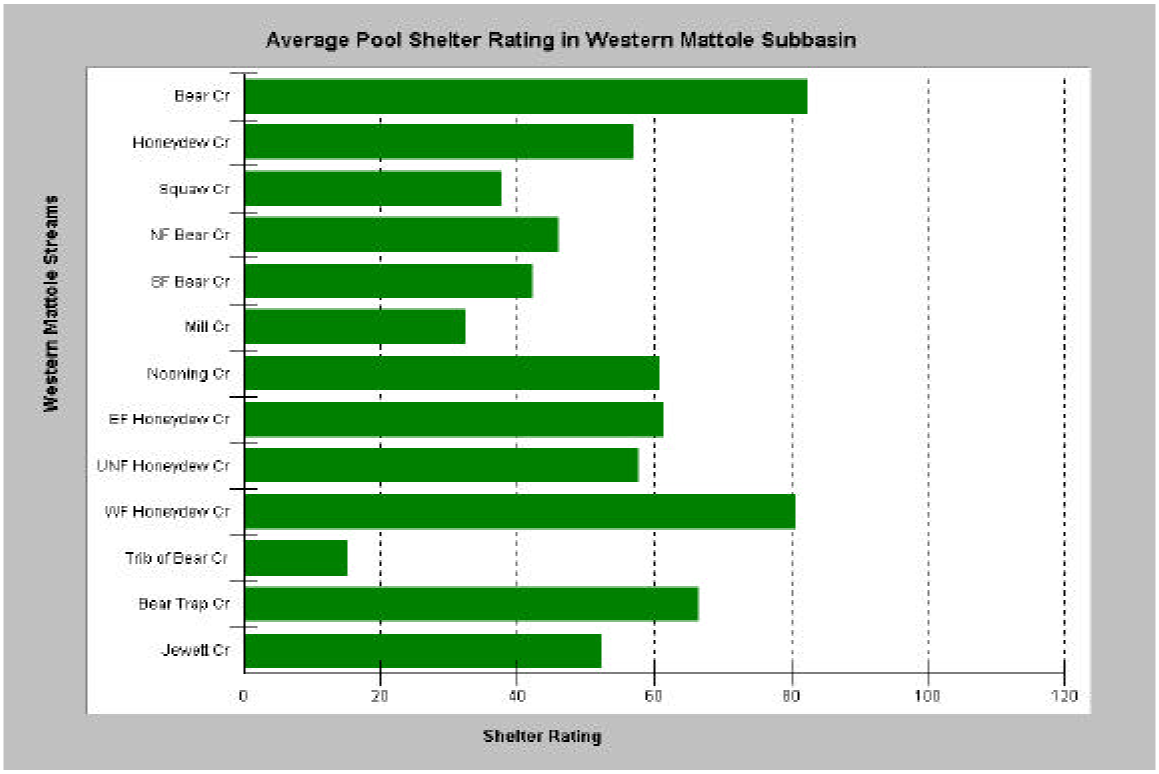

Figure WH5: Average pool shelter ratings from DFG stream surveys of theWestern Mattole Subbasin. An EMDS rating in the range 100-300 is considered fully suitable (X-axis is truncated here). Chart from KRIS Mattole.

Subbasin Trends

The trends for several factors within the Mattole River tributaries in the Western subbasin can be summarized as follows. The size and density of the riparian zone woody vegetation in privately owned timberlands will increase over time due to timber harvesting plan regulations. Those timberlands owned by the public, a significant percentage of the subbasin, are withdrawn from management activities and the size and density of the riparian zone woody vegetation is also expected to increase over time. Trends for riparian zones bordered by or containing roads are also unclear. It is possible that some roads may be abandoned and riparian vegetation re-established, but many of the roads are County roads, lead to streamside County Roads or access rural residential parcels. Riparian vegetation may be sacrificed in road maintenance activities, both regular and storm induced.

The number of roads within this subbasin may remain about the same overall since the Bureau of Land Management (BLM) is removing roads that are no longer necessary for their management objectives while some roads may be built on private timberlands that will be harvested for the first time since the application of current Forest Practice rules. These rules and current practices generally require road systems located high on the slope unlike earlier timber harvest and transportation systems that established roads low on the slopes, often near streams.

The short time period of stream temperature data results does not allow for any trend analysis. There is no data on suspended sediment.

The relative disturbed stream channel percentage was highly variable, but parts of the channel disturbance in the North Fork Bear Creek appeared to have decreased substantially during the time period of 1984 to 2000. Shenanigan Ridge and Woods Creek, both planning watersheds with a lower percentage of disturbed channel remained relatively constant during the time period of 1984 to 2000. Analysis of previous years has not been undertaken to see if this is a continuing trend. Both the 1955 and 1964 floods were one hundred year return events while all other major storm events in the years 1951-2000, the period of record for the Petrolia stream gauge, hover around the ten year flood event level.

Current estimated populations of chinook salmon and coho salmon throughout the Mattole Basin are low compared to United States Fish and Wildlife Service (USFWS) estimated populations in 1960. Outmigrant trapping of steelhead trout appears to indicate that their population is closer to the 1960 USFWS population estimate. However, not enough quantitative data on any salmonid species exists to establish clear trends on a subbasin basis.

Subbasin Issues

- Land use practices on steep and/or unstable slopes should be in accordance with guidelines and recommendations in DMG Note 50.

- Roads – The rural road system is not as extensive as in the other subbasins; however, there is concern over abandoned roads, and road maintenance issues related to landsliding and sediment input on both public and private lands. Without appropriate maintenance or storm proofing, existing roads, both active and abandoned, may continue to supply sediment. BLM is actively removing or "erosion proofing" many of their roads. Road inventories have been completed for a much of this planning basin, and it is recommended that this effort should be continued until a complete inventory is compiled.

- Sub-division and associated impacts are restricted to the northern and eastern margins of this planning basin, outside of the publicly owned lands. BLM's road access policies pertaining to public lands are an ongoing issue with residents adjacent to the public lands.

- Limited water chemistry data available indicates acceptable pH, DO, and nutrient levels.

- Summer high temperatures exceed optimal conditions for salmonid rearing in the lower reaches of the larger streams. Temperatures are within optimal conditions in upstream reaches of larger and smaller tributaries sampled.

- Based on limited sampling, instream conditions indicate moderate sediment levels. The limited data available suggests that there is a degradation of habitat due to instream sediment accumulation in the lower gradient reaches of the larger tributaries.

- Canopy shade in lower order streams and tributaries appear to be adequate. Shade canopy decreases as stream width increases.

- Large woody debris recruitment potential is currently poor for the majority of this planning basin but is expected to improve over time as a result of the BLM management policies within the King Range National Conservation Area.

- Opportunities for public recreation are significant on public lands managed by the BLM, however , the BLM management plans for public access to King Rage National Conservation Area remains controversial.

- Wildlife/Plants – Refer to the BLM watershed analysis documents for Bear, Honeydew, and Mill creeks for detailed information on plant and animal communities. Local landowners report that coyotes are prevalent and uncontrolled.

- The DFG has conducted a preliminary analysis on data collected by BLM since 1996 on seven tributary streams. The results show the samples were rated as good in terms of overall conditions. Additional data for aquatic macroinvertebrate productivity would be useful for effective monitoring purposes.

- Removal of in-stream large woody debris by the DFG and the California Conservation Corps occurred in about forty-nine stream miles in this subbasin during the 1980's. A total of 19,136 cubic feet of wood was removed. This is equivalent to 153 logs 2' x 40'. This activity likely had adverse local impacts on salmonid habitat conditions. Instream habitat diversity and complexity was impacted by this action. Based on current surveys available, instream habitat appears to be recovering.

- In-stream habitat diversity and complexity, based on available survey data, i.e. pool depths, cover, and large woody debris may be adequate for salmonid production.

- Three salmon rearing facilities are located within this planning basin and have been operated by the Mattole Salmon Group since the mid 1980's. These operations have generally been successful and should be continued in order to supplement wild populations of chinook & coho salmon to allow long-term restoration efforts to work.

- In order to protect privacy while developing data, the possibility of training local landowners to survey their own streams to conduct salmonid population status surveys would be advisable to help determine fish populations throughout this planning basin.

Subbasin Issue Synthesis

<u>**Working Hypothesis 1:**</u> ***Summer stream temperatures in some subbasin tributaries are not within the range of temperatures that fully support healthy anadromous salmonid populations.***

<u>**Supportive Findings:**</u>

- MWATs for Honeydew Creek and Bear Creek reached 78.5ºF in 1999 and 71.5ºF in 1998 respectively.

- Squaw Creek had MWATs ranging from 70.4ºF in 1998 to 69.5ºF from 1996-1999.

- Historic timber harvest has reduced canopy closure in near stream areas and likely contributed to elevated stream temperatures.

<u>**Contrary Findings:**</u>

- MWAT of 57.9ºF for 2001 in Nooning Creek.

- MWATs in Mill Creek (lower) consistently within one degree of 58ºF for 1997, 1998, 1999, 2001, 1998-1999.

<u>**Working Hypothesis 2:**</u> ***Aggradation from fine sediment in some stream channels of this subbasin has reduced channel diversity needed to fully support anadromous salmonid populations and has compromised salmonid health.***

Supportive Findings:

- Air photos and field observations show that the Mattole River bordering the Western subbasin downstream of Honeydew Creek is highly aggraded with sediment.
- Field surveys of Lower Honeydew Creek and Squaw Creek found less than 40% of their lower reaches by length were composed of pools, indicating a lack of pool habitat.
- Air photos after the 1955 and 1964 floods indicate significant changes in the stream channel in the Western subbasin.

Contrary Findings:

- V* of 0.26 for Mill Creek, 0.24 for Squaw Creek and 0.22 for Honeydew Creek in 2000 indicating low to moderate residual pool filling.

Working Hypothesis 3: ***A lack of large woody debris in some stream reaches of this subbasin has reduced channel diversity needed to fully support anadromous salmonid populations and has compromised salmonid health.***

Supportive Findings:

- Field observations indicate that amounts of instream large woody debris in the mainstem Mattole River and its tributaries in the Western subbasin are low.
- Historic timber harvest throughout the Western subbasin tributaries frequently removed large conifer vegetation down to the stream bank, severely reducing the available recruitment supply of large woody debris.
- Riparian vegetation is in size classes that are not expected to contribute large woody debris in significant quantities in the near future.

Recommendations:

1) Ensure that near stream areas are managed to reduce solar radiation and moderate air temperatures in order to reduce heat inputs to the Mattole River and its tributaries.

2) Monitor 24 hour summer water and air temperatures to detect trends using continuous monitoring thermographs.

3) Where current canopy is inadequate and site conditions are appropriate, use tree planting and other vegetation management techniques to hasten the development of denser and more extensive riparian canopy.

4) Encourage the monitoring of in-channel sediment and tracking of aggraded reaches in the lower basin by establishing monitoring stations and training personnel.

5) Continue efforts such as road improvements and decommissioning throughout the basin to reduce sediment delivery to the Mattole River and its tributaries.

6) Maintain and enhance existing riparian cover. Use cost share programs and conservation easements as appropriate.

7) Based upon the latest science on placement of large woody debris in stream channels managers in the Western subbasin should work to improve channel structure and function for salmonids.